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ABSTRACTS

of recent published material on Soil and Water Conservation

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SOIL SCIENCE (BASIC)

Soil Physics

Allison, L. E. A STUDY OF SYNTHETIC AGGREGATE BREAKDOWN USING LOGARITHMIC-NORMAL DISTRIBUTION ANALYSIS. Soil Sci. Soc. Amer. Proc. 20: 314-316. 1956.

Logarithmic-normal distribution analysis was applied to a 4-year study of polyelectrolyte conditioned (VAMA) Pachappa loam soil as a means of studying aggregate stability. The data used were from four plots in which the exchangeable-sodium-percentages at time of treatment with conditioner were 3, 29, 40, and 48 respectively. An appreciably higher, and about equal, degree of aggregation due to VAMA treatments was produced in the three high exchangeable-sodium plots, but the aggregates so produced tended to break down more rapidly during a 4-year period than those produced in the presence of low exchangeable sodium.

For aggregates stabilized with VAMA in field plots of Pachappa loam, it was found that following treatment, the geometric mean diameter, M in mm., was related to the time, T in years, by the equation $M = ae^{-T/b}$, where a = M at T = O and b is the relaxation or time constant, i. e., the years required for M to decrease by 63%. For low exchangeable sodium, a = 2.57 mm. and b = .88 year.

Emerson, W. W. SYNTHETIC SOIL CONDITIONERS. Jour. Agr. Sci. 47(1): 117-121. Feb. 1956.

The ability of various high polymers to stabilize soil crumbs was investigated using the sodium saturation technique. The soil used came from two plots on the Rothamsted fields, Branfield and Hoosfield, which have received no fertilizer, either organic or inorganic for 80 years, but whereas the former contains free $CaCO_3$, the latter is acid. The polymers tested were polyvinyl alcohol, sodium alginate, a vinyl acetate-maleic acid co-polymer, polyacrylic acid and a dextran. It was necessary to add 0.2-0.5 percent weight of the polymers in solution to the calcareous soil to produce crumbs of maximum stability, i. e., not dispersing the distilled water. The alginate, however, was effective only if the crumbs were first sodium saturated. With the acid soil, the amount of polyvinyl alcohol necessary for maximum stability was slightly reduced, corresponding to the lower clay content of the soil; whereas only one-tenth the concentration of the maleic acid co-polymer was required. Sodium alginate had no visible effect on the acid soil.

From the swelling pattern of the sodium-saturated crumbs in dilute salt solutions it was inferred that the non-ionic polymers, polyvinyl alcohol and the carboxylated polymers are joined to the edge faces of the crystals. The presence of divalent cations is unnecessary for this edge linkage, as the polymers are equally effective when sodium ions only are present. It is suggested that the polymers form a series of hydrogen bonds with the exposed oxygen and hydroxyl atoms of the octahedral layer. Since these atoms have a greater tendency to co-ordinate a hydrogen ion as the pH is lowered, the carboxylated polymers would be expected to be more efficient on acid soils.

Klute, A., and Wilkinson, G. E. SOME TESTS OF THE SIMILAR MEDIA CONCEPT OF CAPILLARY FLOW: I. REDUCED CAPILLARY CONDUCTIVITY AND MOISTURE CHARACTERISTIC DATA. Soil Sci. Soc. Amer. Proc. 22: 278-281. 1958.

Plainfield sand was dry-sieved into the following five size fractions: 104 to 125, 125 to 149, 149 to 177, 177 to 210, and 210 to 250μ. The bulk densities of the sand fractions, when packed in a standard manner, averaged 1.65 ± 0.01 g. per cc. The particle densities of the fractions averaged 2.61 ± 0.01 g. per cc. The size distribution of each fraction was determined microscopically. The bulk density, particle density, and the reduced size-distribution curves indicated that the sand fractions could be considered similar media.

Lunden, A. O., and Kinch, R. C. THE EFFECT OF HIGH TEMPERATURE CONTACT TREATMENT ON HARD SEEDS OF ALFALFA. Agron. Jour. 49: 151-153. 1957.

Contact heat treatments sustained by allowing alfalfa seed to slide down a heated inclined plane were effective in increasing germination and decreasing hard seed content.

The treatments were more effective for samples high in hard seeds, although the relative effect was similar over all samples.

Miller, S. A., and Mazurak, A. P. RELATIONSHIPS OF PARTICLE AND PORE SIZES TO THE GROWTH OF SUNFLOWERS. Soil Sci. Soc. Amer. Proc. 22: 275-278. 1958.

Sunflowers (Helianthus annuus, L.) were grown in 20 compacted soil separates, ranging in diameters from 4,760 to 2.31μ, which contained pores of diameters between 529 to 2.23μ. Two moisture levels, 20-cm. water tension and moisture content at "flex point," were imposed on the 20 separates. Nutrient solution was applied to the separates.

Noticeably different growth rates of sunflowers were measured at the two moisture levels. Maximum rate of stem elongation at 20-cm. water tension was nearly threefold greater than was that at "flex point" moisture percentage. Maximum growth of sunflowers at 20-cm. water tension was obtained from separates between 52.3 and 210μ in diameter or pores with mean diameters of 17.7 to 43.5μ. Optimum growth of sunflowers at "flex point" moisture was on separates 13.1 to 9.25μ in diameter whose pores were about 4μ in diameter. Aeration appeared to limit the rate of stem elongation when air occupied less than 4% of the pore space.

Maximum growth rate of sunflowers at both moisture levels apparently was determined by the influence of pore size upon aeration and area of root-solution contact. The greater the area of root-solution contact, as determined by pore size and moisture tension, the more favorable was the growth of roots and shoots, provided aeration was not limiting.

Soil Chemistry

Adams, F., and Rouse, R. D. USE OF AN ANION EXCHANGE RESIN TO ELIMINATE ANION INTERFERENCE IN CALCIUM DETERMINATION BY FLAME PHOTOMETRY. Soil Sci. 83: 305-312. 1957.

A rapid method is proposed whereby all solution anions are exchanged for chloride ions in a synthetic anion resin column. Interference caused by phosphate and sulfate ions in the synthesized Ca solutions was completely eliminated by percolating the solutions through the resin column.

Aldrich, D. G., and Buchanan, J. R. ANOMALIES IN TECHNIQUES FOR PREPARING H-BENTONITES. Soil Sci. Soc. Amer. Proc. 22: 281-285. 1958.

Various procedures for the preparation of H-bentonites to be used in physical-chemical studies of clay systems have been examined. Their effects upon the exchangeable H and Al content of these bentonites have been evaluated by titration curves and chemical analyses.

A procedure for reducing the amount of exchangeable Al in such preparations is proposed. This procedure involves pretreatment of the bentonite suspension with hydrochloric acid and sodium chloride solutions followed by removal of excess electrolyte and passage of the suspension through an H-resin column.

The exchangeable H and Al status of bentonites thus prepared is discussed.

Chang, C. W., Dregne, H. E., and Nightingale, H. I. RELATION OF pH TO EXCHANGEABLE SODIUM IN SOILS AS MEASURED IN DILUTE SALT SOLUTIONS. Soil Sci. 82: 387-399. 1956.

This system indicates that the introduction of a suitable amount of neutral salts into the soil-water system effected rapid ionic exchange, and that the pH measured on this system reflected the sodium or calcium status of the soil more accurately than that measured in an aqueous suspension or paste of the same soil.

Hess, H. H., and Thurston, W. R. DISPOSAL OF RADIOACTIVE WASTE ON LAND. Amer. Geophys. Union Trans. 39: 467-473. 1958.

Two years' consideration of the disposal problem by the National Research Council Committee on Waste Disposal has led to certain conclusions which are presented. Waste may be safely disposed of at many sites in the United States but conversely there are many large areas in which it is unlikely that disposal sites can be found as, for example, the Atlantic seaboard. The research to ascertain feasibility of disposal has for the most part not yet been done. The most practical immediate solution of the problem suggests disposal in cavities mined in salt beds or domes. Disposal could be greatly simplified if the waste could be gotten into solid form of relatively insoluble character. Disposal in porous beds underground has capabilities of taking large volumes but will require considerable research to make the waste compatible with such an environment. The main difficulty with this method at present is to prevent clogging of pore space as waste is pumped in.

Jordan, J. V., Lewis, G. C., and Fosberg, M. A. TRACING MOISTURE MOVEMENT IN SLICK-SPOT SOILS WITH RADIOSULFUR: PART I. Amer. Geophys. Union Trans. 39: 446-450. 1958.

Preliminary greenhouse tests using slick-spot soil and associated soil in columns indicated that cobalt and sulfur moved through the soil columns and appeared in the first drainage water. The first field experiments were run south of Boise on the Sebree-Chilcott associated series. Radiosulfur was used in the form of dilute sulfuric acid soaked into absorbent cotton. Each wad was specifically placed in or adjacent to a slick spot. After several months, soil samples from these tagged slick spots indicated that some characteristic water movement had occurred. Improved techniques have been developed and the study will expand to include slick-spot soils in irrigated and dryland areas.

Karim, A., and Islam, A. A STUDY OF ION-EXCHANGE PROPERTIES OF SILT. Soil Sci. 82: 433-436. 1956.

Silt was found to have cation- and anion-exchange capacities of approximately 12 me. and 9 me. percent, respectively.

Miller, J. R., and Axley, J. H. CORRELATION OF CHEMICAL SOIL TESTS FOR AVAILABLE PHOSPHORUS WITH CROP RESPONSE, INCLUDING A PROPOSED METHOD. Soil Sci. 82: 117-127. 1956.

A field pot culture experiment which consisted of 17 Maryland soils, each treated to five levels of phosphorus with superphosphate, was conducted at the University of Maryland Plant Research Farm to determine the correlation of phosphorus soil tests with crop response. In addition, phosphorus soil test values and crop response data from three field experiments at three locations in the State were studied for the same purpose. A part of the research was devoted to the development of a chemical method for determining soluble phosphorus in soils.

The soil series determined to a large extent the correlation between chemically available phosphorus and crop response.

Alfalfa and wheat grown on soils that were initially high in extractable phosphorus often gave little or no response to applied phosphate. The poor correlation of phosphorus extracted by the different chemical methods with crop yields for some soils may partially explain this condition.

Nishita, H., Kowalewsky, B. W., and Larson, K. H. INFLUENCE OF SOIL ORGANIC MATTER ON MINERAL UPTAKE BY TOMATO PLANTS. Soil Sci. 82: 401-407. 1956.

The influence of soil organic matter on the uptake of Ca, Mg, Na, K, Mn, and Sr90-contaminating Vina loam in tracer amounts was studied by pot experiments using the tomato as the test plant.

The mineral uptake and plant yield were influenced by organic matter concentration, incubation time of the soil, and kind of organic matter. In general, the uptake of Sr90 and Ca was highest with 1- or 2-g. additions of organic matter to 100 g. soil. The uptake of these two ions roughly paralleled each other. Magnesium uptake was highest at the 5-g. level of organic matter treatment. Uptake of Na and K increased as organic matter concentration in the soil increased. Uptake of Mn showed no consistent relationship with organic matter concentration or incubation time.

Olson, R. A., Dreier, A. F., and Sorensen, R. C. THE SIGNIFICANCE OF SUBSOIL AND SOIL SERIES IN NEBRASKA SOIL TESTING. Agron. Jour. 50: 185-188. 1958.

Laboratory testing and field trials of fertilizers have established the important Nebraska soil series in definite categories with regard to pH, K and P status. Rather close correlation of subsoil nutrient status with that of the topsoil was noted. Thus little advantage would be expected from subsoil testing for annual crops. Fertilizer yield response data for small grains in the case of phosphorus verified the laboratory observations.

Soil Biology

Broadbent, F. E., Hill, G. N., and Tyler, K. B. TRANSFORMATIONS AND MOVEMENT OF UREA IN SOILS. Soil Sci. Soc. Amer. Proc. 22: 303-307. 1958.

Samples of several California soils were incubated in a controlled environment chamber after addition of varying amounts of urea in solution. Samples were analyzed after time intervals ranging from 1 day to 8 weeks. In short-term experiments analyses for residual urea were performed at frequent, short intervals, and in longer-term experiments nitrification of the hydrolysis product was followed. At 45° F., 200- and 400-ppm. amounts of urea were completely hydrolyzed after 7 days, although some urea remained after 3 days. At 75° F., no urea remained after 2 days when the initial application was 400 ppm. or less. At 800 ppm., considerable urea remained at 3 days but none at 14 days.

Urea was rapidly nitrified in all soils at moderate levels of application but was inhibited in the poorly buffered Hanford sandy loam by the 800-ppm. application, due to the high pH produced.

Leaching experiments with soil columns showed that urea moves less rapidly than nitrate, partly because of rapid hydrolysis to ammonia and partly because urea itself is held by weak absorption forces.

Fuller, W. H., and Hannapel, R. THE INFLUENCE OF NITROGEN ON THE UPTAKE OF PHOSPHORUS BY A TOMATO TEST CROP FROM THREE CROP RESIDUES. Soil Sci. Soc. Amer. Proc. 22: 299-302. 1958.

The uptake of phosphorus from wheat straw, tomato vine, and lettuce residues by a tomato test crop as influenced by different rates of nitrogen additions was studied under greenhouse conditions. The residues were grown in sand-nutrient cultures at different levels of phosphorus containing the radiophosphorus. The residues were then incorporated into two calcareous soils in greenhouse pots at rates equivalent to 50 and 100 pounds of P_2O_5 per acre. Nitrogen was applied at rates ranging from 0 to 400 pounds of N per acre 6 inches. The tomato test crop was grown for 9 weeks before harvesting and analyzing.

The results indicated that the percentage of P in the tomato test crop derived from the different residues was not significantly affected by the rate of application of nitrogen to the soil. This circumstance occurred despite the fact that the percentage of nitrogen and phosphorus, and the dry weight of the test crop was influenced by the rate of application of nitrogen fertilizer. The percentage of P in the test crop derived from the crop residues was not affected by nitrogen additions either in a soil deficient in plant-available phosphorus or one adequately supplied with indigenous available phosphorus. However, the total uptake of plant residue phosphorus by the test crop was significantly influenced by the concentration of phosphorus in the residue.

Soil-Plant-Animal Relationships

Baumgardner, M. F., and Barber, S. A. EFFECT OF SOIL TYPE ON CORRELATION OF SOIL-TEST VALUES WITH CROP RESPONSE. Soil Sci. 82: 409-418. 1956.

An experiment was conducted in the greenhouse and in the field to determine the effect of soil catena and soil drainage profile number on the regression of soil-test value with the amount of nutrient in the soil available to the plant. For the soils investigated, both drainage profile number and catena were found to affect this regression for phosphorus, but to have little effect on the regression for potassium.

Fehrenbacher, J. B., and Rust, R. H. CORN ROOT PENETRATION IN SOILS DERIVED FROM VARIOUS TEXTURES OF WISCONSIN-AGE GLACIAL TILL. Soil Sci. 82: 369-378. 1956.

Corn root penetration studies were made on four Brunizem soils, Ringwood, Saybrook, Elliott, and Clarence, derived from various textures of Wisconsin-age glacial till in northeastern Illinois. Corn roots penetrated to about 4 or 4-1/2 feet in Ringwood derived from sandy loam till and in Saybrook derived from loam till. In Elliott derived from silty clay loam till and in Clarence derived from clay till, not many roots were found below 3 feet. The shallower rooting depths in Elliott and Clarence were attributed to high bulk density and consequent low aeration in the underlying, unweathered, fine-textured tills that lacked soil structural development.

The depths of root penetration and the available soil moisture storage capacity in acre-inches of water to those depths were 48 inches and 9.8 acre inches in Ringwood; 54 inches and 10.6 acre-inches in Saybrook; 36 inches and 7.1 acre-inches in Elliott; and 38 inches and 6.4 acre-inches in Clarence.

Rich, C. I. MANGANESE CONTENT OF PEANUT LEAVES AS RELATED TO SOIL FACTORS. Soil Sci. 82: 353-363. 1956.

Soil factors affecting the availability of manganese to plants grown on Coastal Plain soils of Virginia were evaluated by a procedure of soil and plant sampling, chemical analysis of these samples, and statistical correlations of the results. A study was also made of the effect of air-drying and waterlogging of soils on three manganese tests.

The following soil factors were found to correlate significantly with the content of manganese in plant leaves: pH; cation-exchange capacity; exchangeable manganese, calcium, magnesium, and sodium; and easily reducible manganese.

HYDROLOGY

General

Beaumont, R. T. COOPERATIVE SNOW SURVEYS AND WATER SUPPLY FORECASTING. Soil and Water Cons. 12: 115-119. 1957.

In the mountains of the Western United States, nature has given man a truly convenient means for collecting and providing limited storage of water. This is accomplished each winter as the snows accumulate and the water is stored until spring temperatures release it. The runoff during the growing season of practically all river systems originating in high mountains of the Western States is from snow melt. This phenomenon was responsible for the concept of snow surveys. Snow surveys, in combination with other watershed data, provide the basis for water supply forecasts.

Bornstein, J. DESIGN OF A FLOOD-RETARDING STRUCTURE. Agr. Engin. 37(9): 609 and 617. Sept. 1956.

The author describes the design of a flood detention dam and outlets, the procedure necessary for approval, and legal authorization for construction for the northeastern part of the United States.

Brakensiek, D. L. FITTING A GENERALIZED LOG-NORMAL DISTRIBUTION TO HYDROLOGIC DATA. Amer. Geophys. Union Trans. 39: 469-473. 1958.

A statistical distribution is developed which makes it possible to fit a wide range of positively skewed hydrologic data. It is shown that the general least-squares fitting equations will reduce to simple forms for fitting a normal, log-normal or extreme-value distribution to data. Two fitting processes are developed for fitting data by the so-called generalized log-normal distributions. Examples are given for illustrating the fitting procedures.

Holtan, H. N. ACTUAL AND ESTIMATED FLOODING ON A PROTECTED WATERSHED: SANDSTONE CREEK, OKLA. SCS-TP-129, U. S. Dept. Agr., Soil Cons. Serv., May, 1956.

This report describes methods used in analyzing stream flow data. It presents analyses of some of the first records of flows with a flood-reduction program in actual operation during two major storms.

Lauritzen, C. W., Haws, F. W., and Humpherys, A. S. PLASTIC FILM FOR CONTROLLING SEEPAGE LOSSES IN FARM RESERVOIRS. Bull. 391. Utah Agr. Expt. Sta. in Coop. with U. S. Dept. Agr. July 1956.

Both PE and vinyl film appear to be highly resistant to deterioration when in contact with moist earth. Black PE film likewise appears to be resistant to exposure, but some vinyl films, including opaque films, deteriorated rapidly on exposure in direct sunlight. Both films were resistant to penetration by alfalfa roots. Quackgrass roots penetrated both the 4 and 8 mil vinyl film but did not penetrate PE film. The films in a gage as low as 4 mils will withstand the hydrostatic pressures to which they will normally be subjected in farm reservoirs unless the subgrade material is coarse and characterized by sharp-edged material. The general weakness of the film and the possibility of damage from abrasion or impact will necessitate more than normal precautions in handling and require more careful preparation of the subgrade than may be required for some other types of membrane lining. Areas where the material is gravelly may necessitate the importation of fine textured material for a cushion. The results of our investigations indicate that these films, when employed as buried liners, will be as durable as most other types of membrance linings and more durable than some extensively used. They have the advantage of lighter weight permitting factory fabrication of larger area units, thus necessitating less joining in the field. Because of the flexibility of the film, the subgrade need not be as carefully trimmed.

Orlob, G. T., and Butler, R. G. USE OF SOIL LYSIMETERS IN WASTE WATER RECLAMATION STUDIES. Jour. of Sanitary Engr. Div., Proc. of Amer. Soc. of Civ. Engrs. 82: 1002-1--1002-25. June 1956.

Current interest in waste water reclamation by surface spreading has dictated a need for further study of the mechanism of infiltration, the phenomena which determine the rates of water percolation, and the interaction of porous media and degraded waters. Soil lysimeters are found to be well suited to investigation of many important aspects of the reclamation problem and offer a convenient, economical means of predicting full scale field spreading performance. The behavior of five typical previous agricultural soils under water and sewage spreading conditions are evaluated and a comparison is made between field and lysimeter performance for two of these soils.

Parker, F. L. RADIOACTIVE TRACERS IN HYDROLOGIC STUDIES. Amer. Geophys. Union Trans. 39: 434-439. 1958.

The use of radioactive tracers to study phenomena in hydrology that have not previously been easily amenable to.investigation is proceeding at a rapid pace. A group of experiments was carried out in lakes and reservoirs in Massachusetts to determine eddy diffusion coefficients. The average eddy diffusion coefficient divided by the radius of the eddy was found to be 0.09 ft/sec. A group of experiments to determine the average velocity of streams and the dilution in streams by use of radioactive tracers was then performed. The diffusion coefficients found in the test of the streams were compared with the theoretical diffusion coefficients of G. I. Taylor for straight pipes and found to be larger due to the increased dispersion caused by bends and obstructions in the stream. A mathematical formulation for general use in determining dilution and dispersion in rivers and streams by radioactive tracers was established. A correction is made for the absorption and decay of the isotope depending upon its chemical and nuclear properties.

Rowe, R. R., Long, G. L., and Royce, T. C. FLOOD FREQUENCY BY REGIONAL SYNTHESIS. Amer. Geophys. Union Trans. 38: 879-884. 1957.

Design of highway bridges in California has been predicated on waterways required for 30-yr to 100-yr floods. Determination of such floods is highly speculative because of relatively short stream-flow records. Longer records for an average stream of a hydrologically homogeneous region have been synthesized by combining nondimensional peak discharges, so as to derive factors for extrapolation of frequency curves for each stream of the region.

Reliability of the method, depending upon definition of homogeneity of a region, was tested by a graphical comparison. The test was devised by hypothesizing a 'perfect' 1000-yr flood record and dividing it by chance distribution into 20 50-yr records. Superimposed frequency graphs of these 20 hypothetical records gave a visual measure of disparities to be expected in natural records of comparable streams.

The paper, illustrated by charts, briefs the development of the graphical test, describes the application to one region in California, and shows similar results in a second region of entirely different character.

Straub, C. P., Ludzack, F. J., Hagee, G. R., and Goldin, A. S. TIME OF FLOW STUDIES, OTTAWA RIVER, LIMA, OHIO. Amer. Geophys. Union Trans. 39: 420-426. 1958.

Chemical (sodium chloride), colorimetric (fluorescein dye), and radioactive (rubidium^{86}) tracer techniques were used to measure the time of flow of the Ottawa River below Lima, Ohio. Two runs were made during a two-week period in August 1956, when low stream conditions prevailed. In the first run fluorescein dye and rubidium tracer were introduced into the stream and measured at two stations located 1.0 and 1.9 miles downstream, and in the second, dye and radioactive tracers, and sodium chloride were introduced and measured at three stations located 1.0, 1.9, and 4.5 miles downstream. The results show that under existing test conditions all tracers gave similar results and the maximum deviation was generally less than ten percent. The equipment and facilities needed to carry out the field and laboratory tests are described and the costs and limitations of each method are indicated.

Strahler, A. N. QUANTITATIVE ANALYSIS OF WATERSHED GEOMORPHOLOGY. Amer. Geophys. Union Trans. 38: 913-920. 1957.

Quantitative geomorphic methods developed within the past few years provide means of measuring size and form properties of drainage basins. Two general classes of descriptive numbers are (1) linear scale measurements, whereby geometrically analogous units of topography can be compared as to size; and (2) dimensionless numbers, usually angles or ratios of length measures, whereby the shapes of analogous units can be compared irrespective of scale.

Linear scale measurements include length of stream channels of given order, drainage density, constant of channel maintenance, basin perimeter, and relief. Surface and cross-sectional areas of basins are length products. If two drainage basins are geometrically similar, all corresponding length dimensions will be in a fixed ratio.

Dimensionless properties include stream order numbers, stream length and bifurcation ratios, junction angles, maximum valley-side slopes, mean slopes of watershed surfaces, channel gradients, relief ratios, and hypsometric curve properties and integrals. If geometrical similarity exists in two drainage basins, all corresponding dimensionless numbers will be identical, even though a vast size difference may exist. Dimensionless properties can be correlated with hydrologic and sediment-yield data stated as mass or volume rates of flow per unit area, independent of total area of watershed.

Climatology

Wilson, W. T., and Hershfield, D. M. FREQUENCY ANALYSIS OF RAINFALL INTENSITY DATA. Agr. Engin. 39: 344-347. June 1958.

Soil Conservation Service engineers, in the new Watershed Protection and Flood Prevention program, need frequencies not only for point rainfall, but for areas up to 400 square miles. In addition, they need to know seasonal variation and other characteristics of the rainfall intensity regime. This paper describes the Weather Bureau's work along these lines for a program sponsored by the Soil Conservation Service.

Land Use Influences

Haren, C. C. LAND RESOURCES OF FLUVANNA COUNTY, VIRGINIA. U. S. Agr. Res. Serv. ARS 43-31, 98 pp., illus. July 1957.

Of the land in Fluvanna County, more than 100,000 acres, or three-fifths of the area is suitable for crops, and nearly 40,000 acres, or another fifth could provide a permanent pasture. Only about 10 percent of the acreage in the county is moderately or severely eroded. Modern machinery could be used to good advantage on more than half of the land. A study of 15 sample areas showed that complete development of the land resources of the county would mean clearing woods or brush from approximately two-thirds of the land. The costs of clearing and stumping at 1956 prices probably would amount to about $75 to $100 per acre. Often at least part of the costs could be met through the sale of pulpwood and other timber crops, and it might be feasible to grow crops and develop pastures on such new lands without incurring the heavy costs of removing stumps.

Comparatively heavy applications of fertilizer and lime and application of other practices to improve crop yields would be required, especially on the Nason and Tatum soils. Adoption of measures to control weeds, as well as fertilizing, liming, and seeding to adapted grass-legume mixtures are needed to establish and maintain good pastures. The future value of the timber crop could be increased by selective cutting, removal of undesirable trees, and more effective protection from fires. Many of the properties in Fluvanna County could be developed into relatively large-scale farms; most of the rest would be suited to part-time farming or use for residential purposes. About a fourth of the acreage now in crops and about an eighth of that in pastures would need to be shifted to more conservational uses. Most existing crop and pasture fields also would need to be enlarged. Additional industries are required to increase local incomes and utilize existing public services and facilities more effectively.

Sedimentation

Anderson, H. W. RELATING SEDIMENT YIELD TO WATERSHED VARIABLES. Amer. Geophys. Union Trans. 38: 921-927. 1957.

The yield of sediment from watersheds depends upon three sets of variables: (1) inherent watershed characteristics such as geology and topography; (2) land use, condition of vegetation, and management and protective measures; and (3) nature of storms and stream-sediment measuring device and on which fraction of total sediment yield is measured. The sources of variation in sediment yield between and within watersheds can be evaluated by study of the yield from many watersheds which have wide differences in variables affecting sediment yields. Such studies are useful to determine and evaluate the principal sources of sediment, to evaluate the probable effects of conservation programs on yield, and to provide criteria for design of reservoirs and channels. This paper summarizes some recent studies in which multiple regression analysis was used in relating sediment yield to watershed variables. The studies are discussed in the light of methods of selecting watersheds, data, variables, and functions; and the effects of neglected variables, errors in variables, and exclusion of nonsignificant variables.

Benedict, P. C. FLUVIAL SEDIMENT TRANSPORTATION. Amer. Geophys. Union Trans. 38: 897-902. 1957.

The modes of sediment transport, several related flow parameters and the problem of total load determinations are briefly discussed. The need for additional field and laboratory research to define all factors that affect the sediment discharge of streams is emphasized.

Glymph, L. M., Jr. IMPORTANCE OF SHEET EROSION AS A SOURCE OF SEDIMENT. Amer. Geophys. Union Trans. 38: 903-907. 1957.

Estimating sources of sediment comprising the sediment yield from a watershed is recognized as a difficult but important step in planning means and measures for watershed protection and development. The paper refers to procedures for making such estimates and presents the results of studies on 113 watersheds in various parts of the country. Sheet erosion is clearly the dominant source of sediment in most of the watersheds cited and the opinion is advanced that this is generally the case in the more humid parts of the country. In the cases cited, however, the proportion of sediment yield derived from sheet erosion ranged from 11 to 100 percent of the total and the conclusion is reached that watersheds must be considered individually with respect to sources of sediment.

Gottschalk, L. C. PROBLEMS OF PREDICTING SEDIMENT YIELDS FROM WATERSHEDS. Amer. Geophys. Union Trans. 38: 885-888. 1957.

Three methods in general use for predicting sediment yields from watersheds are: (1) direct sediment-load measurements, (2) estimating yield on the basis of measurements in nearby watersheds, and (3) estimating the rate of erosion in a watershed and the delivery rate of sediment. The third method is a relatively new approach to determination of sediment yield. The objective of the Symposium on Watershed Erosion and Sediment Yields is to assemble existing information and knowledge on sediment yields as a guide to technicians engaged in research and field studies for solution of erosion and sedimentation problems.

Ground Water

Barker, F. B., and Scott, R. C. URANIUM AND RADIUM IN THE GROUND WATER OF THE LLANO ESTACADO, TEXAS AND NEW MEXICO. Amer. Geophys. Union Trans. 39: 459-466. 1958.

Water samples were collected from 47 wells and springs in the Ogallala formation in the Llano Estacado section of the High Plains, Texas and New Mexico. The Ogallala, a fluviatile geologic terrane, is hydrologically and geologically isolated in this region, therefore, the observed radiochemical concentrations are considered as inherent characteristics of the formation in this area. The uranium concentrations ranged from 0.9 to 12 parts per billion (ppb) (median 6.2 ppb), and the radium concentrations ranged from <0.1 to 0.8 micromicrocuries per liter (median 0.1 $\mu\mu c/l$). The uranium concentrations show a tendency to correlate with the gross chemical character of the waters in accordance with the expected chemical behavior of uranium. The departure of the radium-uranium ratios in all samples from radioactive equilibrium value is explained on the basis of carbonate-complexing of uranium and selective adsorption of radium by minerals having a capacity for base exchange.

Bryant, G. T., and Geyer, J. C. THE TRAVEL TIME OF RADIOACTIVE WASTES IN NATURAL WATERS. Amer. Geophys. Union Trans. 39: 440-445. 1958.

Radio isotopes discharged into natural waters (1) precipitate and settle, (2) adsorb on suspended and fixed surfaces, (3) enter the biologic cycle, or (4) in solution move with the flowing, mixing water itself. In the course of its life a single nuclide may shift with more or less freedom back and forth among these alternates. The paper deals with phenomena related to the fourth alternative. Natural waters and the substances carried in solution move and mix in response to complex forces of gravity, wind, tide, density, impact, shear, and inertia. Past studies of mixing and movement are drawn on to depict the time and space distribution of radioactive contaminates in natural water. Tracer studies offer means for evaluating mixing and travel time which may in turn be used to forecast the fate of wastes continuously disposed of in water.

Setter, L. R., and Straub, C. P. THE DISTRIBUTION OF RADIOACTIVITY FROM RAIN. Amer. Geophys. Union Trans. 39: 451-458. 1958.

Under conditions similar to Cincinnati, Ohio, fallout is the result of rainout and snowout. Without precipitation there is little fallout even though the particulate activity of surface air is abnormally high. Much of the suspended activity in cistern water from rain will be removed by sedimentation. Over 90 percent of both the suspended and dissolved fallout becomes associated with soil and vegetation rather than appearing in surface waters. From the spring of 1953 to January 1957, the fallout of strontium^{90} (Y^{90}) in Cincinnati, Ohio, is estimated to be at least ten and probably not more than 30 millimicrocuries per square meter of surface area.

Simpson, E. S., Beetem, W. A., and Ruggles, F. H. RADIOTRACER EXPERIMENTS IN THE MOHAWK RIVER, NEW YORK, TO STUDY SEWAGE PATH AND DILUTION. Amer. Geophys. Union Trans. 39: 427-433. 1958.

Sewage from the Knolls Atomic Power Laboratory near Schenectady, N. Y., was dosed with 4.53 curies of P^{32} prior to discharge into the Mohawk River. Its pattern of diffusion was measured in the river with immersible GM-tubes and by sampling. The initial path of sewage was strongly influenced by differences in density between sewage and river due to temperature. During warm months relatively cold sewage moved on the river bottom perpendicularly to river current. For at least the first 800 ft. of travel the maximum sewage concentration decreased logarithmically with distance from outfall. The term 'half-distance' (here about 110 ft.) is proposed to describe the concentration change. During cold months sewage rose to the river surface and at times was moved upstream by wind. However, when the river temperature was near freezing, the sewage first rose and then sank as the temperature of the sewage-river mixture approached 39^{o}F.

Hydraulic Structures

Kemper, W. D., and Lutz, J. F. HYDRAULIC CONDUCTIVITY IN LARGE CHANNELS AS DETERMINED BY AN ELECTRIC ANALOG. Soil Sci. 81(4): 283-286. Apr. 1956.

Data from the electric analog were used to develop an equation relating the number and length of highly conductive channels to their contribution to over-all hydraulic conductivity.

SOIL AND WATER MANAGEMENT

General

Nichols, M. L., Reaves, C. A. SOIL REACTION: TO SUBSOILING EQUIPMENT. Agr. Engin. 39: 340-343. June 1958.

At the National Tillage Machinery Laboratory a wide range of designs of subsoilers have been studied in the soil bins of the Laboratory and their use has been observed in the field. These studies have been supplemented in the Laboratory with equipment specially designed to study sub-surface reaction before different designs to determine how various features of design affect soil reactions and something of the "why" of the reaction. This apparatus and method of use are described with observation of the interaction of soil and implement. A general principle of reaction of soil to force application is advanced. The effects of soil moisture are pointed out and a quick field method of evaluating critical conditions suggested. Since it appeared that the effectiveness of subsoiling depended in part at least upon the shattering of the soil, particular attention was given to factors affecting this reaction.

From the combination of bin and field tests and laboratory observation of reactions, it was found that a major factor in power requirement is the horizontal pressure of the standard against the soil which materially increases the force required for shear or fragmentation. Data from experimental subsoilers designed to relieve this pressure are included.

Fertilizers and Soil Fertility

Albritton, D. J., and Ellis, R., Jr. INFLUENCE OF ORGANIC MATTER AND CERTAIN ANIONS ON THE YIELD AND PHOSPHORUS CONTENT OF OATS. Agron. Jour. 49: 410-412. 1957.

In pot culture experiments the influence of organic materials and certain anions on yields and phosphorus contents and uptake by oats were investigated. Silicate supplement was especially effective, much more so than organic materials, in increasing yields and phosphorus uptake.

Boswell, F. C., and Parks, W. L. THE EFFECT OF SOIL POTASSIUM LEVELS ON YIELD, LODGING, AND MINERAL COMPOSITION OF CORN. Soil Sci. Soc. Amer. Proc. 21: 301-305. 1957.

Five corn hybrids (three single crosses and two double crosses) were grown on a soil low in exchangeable potassium. Four potassium fertility levels were used. K, Ca, Mg, and P were determined on leaf samples collected periodically throughout the growing season. Root lodging and stalk breakage were also determined periodically. A significant yield increase from the first increment of K_2O was obtained, but no further increase was obtained from additional increments. Significant yield differences among corn hybrids were obtained. Potassium fertilization significantly decreased both root lodging and stalk breakage. The corn hybrids were found to differ significantly in their root lodging and stalk breakage characteristics.

The potassium content of the plant increased with increased rates of potassium fertilization. The maximum potassium content of the plant was observed during the early stages of plant growth and the potassium content decreased percentagewise as the plant neared maturity. The calcium and magnesium contents of the leaf tissue were generally inversely related to the potassium content of the plant. The phosphorus content was unaffected by the potassium fertility treatments. The milliequivalents of total cations (K, Ca, Mg) per 100 g. of oven-dry tissue decreased at a given stage of plant growth as the rate of potash fertilization increased, increased with age of plant at the lower potassium levels, and remained essentially constant throughout the life of the plant at the highest potassium level. The sum of the percent K, Ca, and Mg content of the plant was essentially a constant at all stages of growth.

Bray, R. H. THE CORRELATION OF A PHOSPHORUS SOIL TEST WITH THE RESPONSE OF WHEAT THROUGH A MODIFIED MITSCHERLICH EQUATION. Soil Sci. Soc. Amer. Proc. 22: 314-317. 1958.

Variations in soil, season, and variety were found not to change the relative response of wheat to a soluble phosphate. But the difference in distribution pattern between the applied and native sorbed phosphorus varied their efficiencies such that the response to the applied phosphorus followed a c log x form of the Mitscherlich equation. Value of c for log x and c_1 for b_1 were established. When easily acid-soluble forms are absent these constants can, through soil tests, be used to calculate approximate fertilizer needs and percentage responses obtainable with wheat for a broadcast and double-disced application of soluble phosphate. The results obtained are in agreement with the writer's nutrient mobility concept.

Brown, D. A., and Wells, J. P. ION EXCHANGE IN SOIL-PLANT ROOT ENVIRONMENTS: III. THE USE OF Mg^{28} FOR THE MEASUREMENT OF MAGNESIUM ABSORPTION BY PLANTS. Soil Sci. Soc. Amer. Proc. 22: 323-326. 1958.

The availability of the Mg^{28} isotope having a half-life of 21.3 hours has presented the possibility of its use in the measurement of the available magnesium in soils. Data are presented to show the relative proportions of fertilizer and soil magnesium adsorbed by cation-exchange resin sheets over the time periods up to 96 hours. The percentage of magnesium adsorbed from the tagged magnesium fertilizer remained relatively constant for exchange periods from 48 to 96 hours; being of the order of 76.6, 57.8, and 53.9% for soils with 50, 150, and 250 pounds per acre of exchangeable magnesium, respectively.

Four-week-old corn plants adsorbed adequate Mg^{28} during a 96-hour period for radioactive analysis of the nonadsorbed, adsorbed magnesium on corn roots, and permitted the analysis of the absorbed magnesium in the roots and tops. Increasing the rate of magnesium fertilizer increased the percentage of magnesium derived from the fertilizer in each of the different stages of nutrient uptake. Conversely, at any one fertilization rate, increasing the level of soil magnesium reduced the percentage of magnesium derived from the applied fertilizer.

These data indicate that the Mg^{28} isotope is usable up to periods of at least 7 half-lives for nutrient uptake and cation-exchange studies.

Dawson, M. D. INFLUENCE OF BASE SATURATION AND CALCIUM LEVELS ON YIELD AND MINERAL CONTENT OF ALFALFA. Soil Sci. Soc. Amer. Proc. 22: 328-333. 1958.

A greenhouse investigation was carried out on four pedologically contrasting soils. The soils were limed to different base saturation levels. Yield and mineral composition were determined for the alfalfa grown on these soils.

Soil pH readings at the same base saturation levels varied considerably on the different soils. The pattern of alfalfa response to lime also varied. On the Brown Latosol optimum growth was obtained at 40% base saturation while the other three soils gave optimum growth at either 80 or 100% base saturation. The yield response was attributed to either the direct or indirect effects of lime. Concurrently a split-root experiment was conducted to study the effects of additional calcium supplied to an isolated section of alfalfa roots at each base saturation level. Additional calcium supplied to isolated root sections independent of the soil increased alfalfa yield significantly on two soils. The addition of calcium to the roots also decreased the manganese content of the foliage.

Howe, D. O., and Graham, E. R. SALT CONCENTRATION A FACTOR IN THE AVAILABILITY OF PHOSPHORUS FROM ROCK PHOSPHATE AS REVEALED BY THE GROWTH AND COMPOSITION OF ALFALFA. Soil Sci. Soc. Amer. Proc. 21: 25-28. 1957.

A study of the availability of phosphorus held in rock phosphate in relation to the soluble salt content of sand-clay cultures was made. An effort was made to relate the availability of the phosphorus to the relative bonding energies of Putnam clay for calcium, magnesium, potassium, and hydrogen. Alfalfa was grown as the test crop. The less than 0.2 μ Putnam clay was brought to desired cation saturation by making the system unsaturated by treating the Na suspended clay with hydrogen-Amberlite (IR-120), electrodialyzing to reconcentrate, and then adding carbonates or hydroxides of Ca, Mg, and K. Trace elements and nitrogen as ammonium nitrate were added in small amounts. Phosphorus was added as either rock phosphate or phosphoric acid. Calcium, magnesium, potassium, and sodium salts were added. Calcium and magnesium salts were added in series at 0.010, 0.020, 0.041, 0.081, and 0.163 moles per liter and potassium and sodium salts at 0.020, 0.041, 0.081, and 0.163 moles per liter of soil water.

The results showed all salts influenced the availability of phosphorus held in rock phosphate. However, calcium salts reduced phosphorus uptake with small reduction in plant yields. Variable effects on plant yields and phosphorus uptake resulted when magnesium salts were used. Potassium salts of different anions produced different degrees of response, with the first increments of the carbonate and sulfate giving a positive yield response while the chloride depressed growth and phosphorus uptake. Sodium sulfate gave a reduction in crop yields and phosphorus uptake indicating an influence of excessive sodium.

Ibach, D. B. USE OF STANDARD EXPONENTIAL YIELD CURVES. U. S. Agr. Res. Serv. ARS 43-69, 24 pp., illus. Feb. 1958.

Economic interpretation of yield response to fertilizers based on use of standard exponential yield curves can be accomplished with a few calculations that involve only simple arithmetic. Fitting the curve does not require the use of a computing machine, but a machine or a slide rule will be needed in finding the most profitable rates of application and in related calculations. The procedure to be used is set forth in detail.

Kamprath, E. J., and Miller, E. V. SOYBEAN YIELDS AS A FUNCTION OF THE SOIL PHOSPHORUS LEVEL. Soil Sci. Soc. Amer. Proc. 22: 317-319. 1958.

A survey was conducted to determine the relationship between the yield of soybeans and the nutrient level of the soil. The yield of soybeans was related to the soil phosphorus level and the soil pH. When the yields of soybeans were placed into the various soil test categories for phosphorus, it was found that the lowest average yield was in the low soil phosphorus category and the highest average yield in the high soil phosphorus range.

Studies in the greenhouse also showed that the yields of soybeans were related to the soil phosphorus level. The response of soybeans to the addition of phosphorus was dependent upon the soil phosphorus level.

Lang, A. L., Pendleton, J. W., and Dungan, G. H. INFLUENCE OF POPULATION AND NITROGEN LEVELS ON YIELD AND PROTEIN AND OIL CONTENTS OF NINE CORN HYBRIDS. Agron. Jour. 48(7): 284-289. July 1956.

Protein and oil content of grain was found to decrease with higher plant populations and lower N levels. Of yield components, ears per 100 plants were influenced most by varying populations and fertility levels. The 9 single-cross hybrids tested showed different yield responses to N levels and populations.

Larsen, J. E., Warren, G. F., and Langston, R. STUDIES OF PHOSPHORUS AVAILABILITY IN ORGANIC SOILS. Soil Sci. Soc. Amer. Proc. 22: 336-339. 1958.

Experiments were conducted on the phosphorus status of organic soils by correlating the phosphorus solubility in various extractants with percentage yields of tomato, peppermint, and onion. Seven different extractants, including water, were compared using four ratios of soil volume to extractant volume. Distilled water extracts gave the most accurate estimates of plant-available phosphorus in a ratio of soil volume to extracting solution of 1:20 for the organic soils and 1:10 for the mineral soil.

The threshold value at which yields were not increased with additional applications of phosphorus under greenhouse conditions was established at 10 and 16 pounds per acre of water-soluble phosphorus when the soil and the water were shaken for 2 minutes and 30 minutes, respectively.

Mederski, H. J., and Hoff, D. J. FACTORS AFFECTING ABSORPTION OF FOLIAR-APPLIED MANGANESE BY SOYBEAN PLANTS. Agron. Jour. 50: 175-178. 1958.

Manganese concentration in soybean plants increased 200 ppm. after 15 minutes contact between plant surfaces and applied manganese sulfate solution. Manganese absorbed by the leaves and stems increased with increasing manganese concentration in the applied solution, and with an increase in plant temperature and the length of time the manganese remained in solution on the leaf surface. A portion of the accumulated manganese appears to be held by adsorption at the leaf surface.

Moore, D. G., Attoe, O. J., and Rich, C. I. RECOVERY BY ELEVEN CROPS OF OATS OF PHOSPHORUS APPLIED TO POT CULTURES OF FIVE SOILS. Agron. Jour. 49: 560-563. 1957.

Recovery of applied phosphorus by 11 oat crops ranged from 51 to 72%, and recovery by the first crop was less than 20% from the silt loams and about 35% from a sand. Total percentage of applied phosphorus recovered by cropping and acid and alkali extractions combined ranged from 74 to 100%. Phosphorus applied at 22 to 589 ppm. to Spencer silt loam gave nearly the same percentage recovery by the 11 crops.

Nelson, L. E. RESPONSE OF SOYBEANS GROWN IN THE GREENHOUSE TO ZINC APPLIED TO A BLACK BELT SOIL. Soil Sci. 82: 271-274. 1956.

Bulk samples of soil were taken from areas in a Black Belt soil in which soybeans were chlorotic and normal, and after fertilization with $ZnSO_4$ and Es-Min-El were cropped in the greenhouse. Although severe chlorosis of the unfertilized plants did not occur, a vegetative response of soybeans to zinc fertilization was obtained. The zinc content of the soybean tops was not increased by zinc additions to the soil, but total zinc uptake from the soil was increased. The zinc content of the soybean plants grown in the deficient soil was approximately 15 p.p.m.; whereas that from plants grown on normal soil was 30 p.p.m.

Otto, H. J., and Herbert, L. E. INFLUENCE OF NITROGEN AND POTASSIUM FERTILIZATION ON THE INCIDENCE OF STALK ROT OF CORN. Agron. Jour. 48(7): 301-305. July 1956.

Severity of stalk rot in corn increased with applications of nitrogen and decreased with increased potassium applications. Corn hybrids responded to fertilizer treatments in different degrees.

Ramig, R. E., and Koehler, F. E. WHEN MOISTURE IS RIGHT NITROGEN WILL GIVE BIGGER WHEAT CROPS. Nebr. Agr. Expt. Sta. Summer, 1955.

Where North Platte soil is soaked at seeding time, fertilizer boosts yields; 40-pound rate as good or better than 80-pound application.

Robertson, W. K., Fiskell, J. G. A., Hutton, C. E., Thompson, L. G., Lipscomb, R. W., and Lundy, H. W. RESULTS FROM SUBSOILING AND DEEP FERTILIZATION OF CORN FOR TWO YEARS. Soil Sci. Soc. Amer. Proc. 21: 340-346. 1957.

Data on six soil types in North and West Florida for two years were used to evaluate subsoiling and deep placement of fertilizer. Lime, fertilizer, fertilizer plus lime, and fertilizer plus lime plus minor elements placed in the subsoil were compared with subsoiling alone and surface fertilization at low and high rates. Corn yields, root distribution and the chemical composition of ear leaves were used to measure responses.

Where organic hardpans existed, as on the Leon fine sand, Ona fine sand, and combinations of these soil types with related soils, yield increases were obtained for subsoiling alone and fertilizer, lime and/or minor elements placed in the subsoil. Responses to fertilizer were related to the chemical composition of the soil profile and rainfall distribution. Better responses were obtained when moisture stress periods occurred during the first part of the season. The Norfolk loamy fine sand, Ruston fine sandy loam and Red Bay fine sandy loam soils contained compact clay zones or plow soles beneath the surface. When drought periods were of short duration, subsoiling and deep placed fertilizer improved corn yields above the check. When the drought period was of 25 days' duration the advantage of having a deeper root system and a larger corn plant was lost.

On the Klej fine sand where there was nothing in the profile to impede roots, fertilizer on the surface was as good as deep placement and subsoiling alone was of no benefit.

The residual effects of the subsoiling treatments were generally small. There was some indication that it would be necessary to subsoil annually even though additional fertilizer in the subsoil may not be needed.

Rouse, R. D. THE POTASSIUM STATUS OF HARTSELLS FINE SANDY LOAM AS AFFECTED BY POTASSIUM FERTILIZATION. Soil Sci. Soc. Amer. Proc. 22: 334-336. 1958.

The K status of Hartsells fine sandy loam was characterized in the field by cropping for 18 years at rates of K ranging from 0 to 80 pounds per acre followed by 9 years of cropping without further additions. The K supplying power, exchangeable K, K content of cotton leaves, and cotton yield were determined annually during the residual period. These data indicate that the easily replaceable nonexchangeable K and the exchangeable K are both of value in sustained crop production.

The rate of K application found to be adequate during the rate's study was inadequate when applied to former check plots until the application had been repeated annually for 5 or 6 years. It was found feasible to bring plots to a desired level of exchangeable K by discreet additions.

Wahhab, A., and Muhammad, F. NITROGEN AND PHOSPHORUS FERTILIZATION OF PEANUTS (Arachis hypogaea). Agron. Jour. 50: 178-180. 1958.

The use of 37.5 pounds of available P_2O_5 gave an increased yield of 257 pounds of nuts per acre. Under favourable conditions up to 520 pounds of nuts could be obtained. N alone did not increase the yield of nuts significantly. N reduced the beneficial effect of P when used in combination.

Wilcox, O. W. AGRIBIOLOGIC PERCENTAGE METHOD OF EVALUATING FERTILIZER TESTS: V. APPLICATION TO AN EXPERIMENT ON THE JOINT EFFECTS OF NITROGEN FERTILIZER AND RATES OF PLANTING; THEORY OF BARRENNESS IN CORN. Soil Sci. 83: 313-324. 1957.

"The agribiologic percentage method of evaluating field tests with fertilizers" is extended to include the problem of plant population, or density of stand, which involves the influence of areal space as a factor of plant growth. "The agribiologic percentage method of evaluating field tests with fertilizers" consists of a comparison of obtained yield from each treatment with a theoretical yield calculated for that treatment by the Mitscherlich-Baule yield equation.

Younts, S. E., and York, E. T., Jr. EFFECT OF DEEP PLACEMENT OF FERTILIZER AND LIME ON YIELD AND ROOT ACTIVITY OF CORN AND CRIMSON CLOVER. Soil Sci. 82: 147-155. 1956.

The primary objective of this study was to determine the effects of distributing the lime and fertilizer at specified depths in soils to 24 inches on yield and nutrient content of corn and crimson clover. Root activity as reflected by the absorption of Ca^{45} and water was also related to the manner in which the fertilizer was applied.

Concentrating fertilizer in the surface 6 inches tended to promote the development and activity of corn roots at lower depths early in the growing season as measured by both Ca^{45} and moisture utilization. Later as the plants approached maturity, roots were somewhat more active where the fertilizer was distributed throughout the 24-inch depth. Irrespective of placement, nitrogen tended to repress root activity at a depth of 24-26 inches as reflected by Ca^{45} absorption.

Dry matter yields of corn were unaffected by the depth of lime and fertilizer distribution. Crimson clover yields on the other hand were increased somewhat where the soil was limed and fertilized to a depth of 24 inches, and there yields could be related to the increased absorption of potassium with deeper placement. No other effect of lime and fertilizer distribution upon nutrient content of the plants was observed.

Drainage

Ede, A. N. CONTINUOUSLY FORMED CONCRETE TUBE FOR DRAINAGE. Agr. Engin. 38: 864-866. Dec. 1957.

The purpose of this study was to determine whether a cheap channel stabilization material could be used with the moleplow to eliminate tile-laying operations in many soils. Concrete was selected as being cheap, readily available material of properties which might enable it to be used direct from the mixer and to be formed in situ as a tube in one operation sequence.

Irrigation

Amemiya, M., Robinson, C. W., and Cowley, E. W. RECLAMATION OF A SALINE-ALKALI SOIL IN THE UPPER COLORADO RIVER BASIN. Soil Sci. Soc. Amer. Proc. 20: 423-426. 1956.

An experiment to determine the feasibility of reclaiming an unproductive saline-alkali calcareous soil (Billings silty clay loam) in the Upper Colorado River Basin was established near Grand Junction, Colo. The effects of leaching and gypsum on the reclamation of this soil, which is typical of the soils of the Upper Colorado River Basin, were followed by periodic soil analysis and by measuring the yield of alfalfa.

The amounts of soluble salts and exchangeable sodium in the soil were materially decreased by the leaching treatments. This decrease was a function of the amount of water used to leach the soil. From 4 to 6 feet of water were required to reclaim such soils to a depth of 50 inches. Gypsum application in combination with leaching had little or no effect on reducing exchangeable sodium.

After cropping with alfalfa for 1 year, soluble salts and exchangeable sodium adversely affected the yield of alfalfa where only 2 feet of water were used to reclaim. There are indications that salts and exchangeable sodium may be re-accumulating in the profile.

Soil differences attributable to different reclamation treatments significantly affected the yield of alfalfa. Plots leached with 6 feet of water yielded 5.15 tons of hay per acre, as compared with 4.37 tons per acre obtained from plots leached with only 2 feet of water. Yield differences were attributed to differences in the chemical and physical properties of the soil which resulted from the reclamation treatments.

Clark, F., Myers, J. M., Harris, H. C., and Bledsoe, R. W. YIELD AND QUALITY OF FLUE-CURED TOBACCO AS AFFECTED BY FERTILIZATION AND IRRIGATION. Bull. 572, Univ. of Fla. Agr. Expt. Sta., Mar. 1956.

Total yield and high quality yield of tobacco were increased by the use of irrigation during each of three years, but in 1950 the effect of irrigation treatments on total yield was not significant.

One-half inch of irrigation water per application gave better results than three-fourths inch when the net economic benefits were considered.

The number and distribution of irrigation applications was dependent upon rainfall and its distribution. Seven to 12 applications were required to maintain a suitable soil moisture level during the three years. It also appeared that 13 to 15 inches of water (rainfall and irrigation) were necessary to produce a satisfactory crop of high quality tobacco.

Both yield and quality of tobacco were influenced by fertilization. Sixteen hundred pounds per acre of fertilizer, in two applications, increased yield and improved quality more than any other fertilizer variable tested. Amount and quality of tobacco produced are favorably influenced more by the split application of fertilizer than by the rate of application.

Gertel, K., Thomas, J. W., Thorfinnson, T. S., and Ottoson, H. W., ADJUSTING TO IRRIGATION IN THE LOUP RIVER AREA IN NEBRASKA. Nebr. Agr. Expt. Sta. Bul. 434, 70 pp., illus. Feb. 1956.

These irrigation areas are mainly on valley lands flanked on both sides by rough, hilly land, chiefly in grass. Farming units usually contain irrigable land, nonirrigable cropland, and dryland pasture. The anticipated use of irrigable land is a rotation of corn, oats, and alfalfa, with emphasis on corn. Some farmers raise sugar beets and potatoes. Beef cattle and hogs are major livestock enterprises, and poultry and dairying are minor enterprises. With irrigation on the better farmlands, average yields of 70 bushels of corn, 42 bushels of oats, and 4.6 tons of alfalfa hay per acre may be expected. The average size of farm has increased steadily and may be expected to continue to do so if introduction of irrigation does not arrest the trend. Profitable family farms may be developed on 160 acres with 100 to 120 acres of good irrigable land, provided a sizable herd of high-producing dairy cows and hogs and poultry are included in the organization. Corn and alfalfa would be the major crops, but net income would be increased by substituting sugar beets for part of these crops. With less intensive production, a family farm could be developed on a 240-acre unit having 135 acres of irrigable land. It pays to develop irrigated land as rapidly as possible, but many farmers hesitate to incur the cost of total development in a single year. Incomes on both dry and irrigated farms vary considerably; those on irrigated farms do not fall as low as those on dry farms. Farm leases are likely to be adjusted as a result of irrigation. This is especially true of crop-share leases. With irrigation, landlords will participate in the farm business to a larger extent.

Lanoix, J. N. RELATION BETWEEN IRRIGATION ENGINEERING AND BILHARZIASIS. Bull. of World Health Organization, Palais des Nations, Geneva, Switzerland, Vol. 18, No. 5-6, pp. 1011-1035, 1958.

The author discusses the relation between irrigation systems and the transmission of bilharziasis, with special reference to the important part the irrigation engineer can play in checking the spread of the disease. He points out that, in the past, there has been little co-operation between health departments and public works agencies in respect to the setting up of irrigation systems, and stresses the advantages to be gained from an active collaboration between malacologists, epidemiologists and irrigation engineers at the planning stage of irrigation schemes.

The author also puts forward some suggestions for research on irrigation-system design and outlines the role of WHO in bilharziasis control.

Van't Woudt, B. D. INFILTRATION BEHAVIOR UNDER FURROW AND SPRINKLER IRRIGATION. Agr. Engin. 38: 310-311, 319-320. 1957.

Relatively large cracks were found to cause uneven infiltration temporarily, but the effect of soil cracks was overcome as the opposite walls of the cracks cave together, caused by swelling of the surrounding soil. No movement into or through the cracks takes place unless the soil is in a saturated condition.

The pattern of moisture distribution in the soil appeared the same under both methods of irrigation, with the exception that the crest of the ridge between the furrows remained unwetted in the case of furrow irrigation.

Soluble salts in the surface soil are pushed toward the crest of the ridges in furrow irrigation, but under sprinkler irrigation the salts are pushed evenly down the profile.

Excessive discharge in the draintile system in an area under furrow irrigation could not be attributed to the rapid movement of applied water through soil cracks, but appears to be caused by continued irrigation after the soil is completely saturated to the depth of the drains.

Erosion Control

Coldwell, A. E. IMPORTANCE OF CHANNEL EROSION AS A SOURCE OF SEDIMENT. Amer. Geophys. Union Trans. 38: 908-912. 1957.

A specific statement is not possible as to the percentage of total erosion caused by channel erosion. Watersheds containing tight soil may be almost entirely free of gullies, streams may have deep and narrow channels with stable banks, and slopes may be small, resulting in little bed movement. On the other hand, watersheds draining upland sandy areas may have many gullies with rapid headward movement; channels may be shallow and wide, with such widening actively increasing at the present time; and steep slopes may cause a considerable amount of bed movement. Combinations of these factors may occur in a single watershed. Absence of sediment measuring stations on gullies makes volumetric estimates based on rate of change in depth, width, and headward movement necessary. Establishment of valley and channel range profiles is helpful in estimating bank erosion. It is being found that aerial photographs taken some years apart indicate that bank erosion may cause a greater part of the erosion in a watershed than was previously supposed. Confirmation of this is indicated by relatively permanent shifts in discharge rating curves. For bed movement reliance must be placed on current research and established formulas.

Gleason, C. H. RECONNAISSANCE METHODS OF MEASURING EROSION. Jour. Soil and Water Cons. 12: 105-107. 1957.

This paper based on studies in California brushland burns describes four kinds of reference points that can be established easily to help measure erosion at the place where it occurs. The methods employ gully bisects, spikes with loose-fitting washers, bottle-caps, and the use of paint in pressurized cans.

Smith, D. D., and Wischmeier, W. H. FACTORS AFFECTING SHEET AND RILL EROSION. Amer. Geophys. Union Trans. 38: 889-896. 1957.

This paper discusses the two principal processes by which sheet erosion occurs and the six factors which effect the magnitude of the losses. The processes are raindrop impact and transportation of soil particles by flowing water. The factors are length and percent slope, cropping, soil, management and rainfall. The relative effectiveness of each of the three main conservation practices in control of erosion, contour farming, strip cropping, and terracing is presented. The factors and practices are combined in a rational erosion equation for calculating field soil loss for use in application of conservation practices and in assessing land program benefits.

Smith, J. L., and Crabb, G. A., Jr. PATTERNS AND CLASSES OF RAINFALL AT EAST LANSING, MICHIGAN, AND THEIR EFFECT UPON SURFACE RUNOFF. Quar. Bull., Mich. Agr. Expt. Sta., Vol. 39, No. 1, pp. 47-62. Aug. 1956.

Of the three factors: class, pattern, and total of storm rainfall, total amount of storm rainfall is of more significance in producing runoff than intensity under cultivated conditions. However, because of the complex inter-relation between these factors and those of soil moisture, vegetal cover, climatic and physical conditions, none of these factors can be accepted alone as a primary runoff-producing factor. Rather, they must all be evaluated collectively as causes of runoff.

Van Doren, C. A., and Bartelli, L. J. A METHOD OF FORECASTING SOIL LOSS. Agr. Engin. 37(5): 335-341. May 1956.

A method used for determining soil loss from various soils in Illinois under different management and conservation programs is presented. The procedure is based on the analysis and evaluation of the different factors influencing the amount of soil movement. The relative importance of these factors was determined by a study of soil losses under controlled conditions at the various soil experiment stations. Each factor was considered singly while the others were kept constant.

Wagner, L. F. SOIL EROSION PROBLEMS IN A COASTAL COUNTY. Public Works, Vol. 89, No. 11, pp. 93-94, 150, 151. Nov. 1958.

The author discusses erosion problems connected with the 620 miles of roads in the Ocean County road system. Some of the problems he takes up in erosion are roadside ditches, 'fixing' sand dunes, and wave action on shore roads. He sums up by saying that some methods have been developed to cope with some of the various erosion problems, and as many as are available of these methods are carried out, but there still remains an unlimited amount of work and new methods to be thought of and developed.

Tillage and Cultural Practices

Day, A. D. EFFECT OF LODGING ON YIELD, TEST WEIGHT, AND OTHER SEED CHARACTERISTICS OF SPRING BARLEY GROWN UNDER FLOOD IRRIGATION AS A WINTER ANNUAL. Agron. Jour. 49: 536-539. 1957.

The grain yield, test weight, and weight per 1,000 seeds were decreased as a result of 90° lodging treatments of irrigated spring barley grown as a winter annual. Lodging treatments of 45° and 90° resulted in a decrease in the percentage of plump kernels and the grain color score. The percentage of thin kernels was increased as a result of 90° lodging treatments.

Haynes, J. L., and Sayre, J. D. RESPONSE OF CORN TO WITHIN-ROW COMPETITION. Agron. Jour. 48: 362-364. Aug. 1956.

In rows 8-1/2 feet apart, highest ear corn yields occurred at closer within-row spacings than those which usually give maximum yield at closer between-row spacings. Differences in within-row spacings from 1 to 4 inches had little effect on total plant weight per acre, but the closer spacings within this range increased the stover:ear ratio. Root pattern of individual plants changed from circular to oblong at within-row spacings below 8 inches.

Kuska, J. B., and Mathews, O. R. DRYLAND CROP-ROTATION AND TILLAGE EXPERIMENTS. U. S. Dept. Agr. In Coop. with Kans. Agr. Expt. Sta., Cir. 979, June 1956.

This circular reports the results of experiments in crop-rotation and tillage methods at the Colby (Kans.) Branch Experiment Station during the years 1915-50. The soil is a brown silt loam of high fertility. It is a deep, friable soil, easily worked and well adapted to the production of a variety of crops. The average annual precipitation for the 37-year period, 1914-50, was 18.48 inches. The average for the 6 months, April to September, was 14.24 inches. More than three-fourths of the precipitation falls during the growing season. The yields of winter wheat on fallow averaged practically double the yields of the best methods on cropland. During the years no tillage method or rotation used in growing wheat on land cropped every year was effective in producing a substantial increase in yields. Moisture storage on cropped land varied little under different tillage methods.

McAlister, J. T. MULCH FARMING GAINS FAVOR IN SOUTHEAST. Agr. Engin. 38: 313-315. 1957.

Mulch farming is one of the greatest techniques of holding soil--keeping it out of the sky, out of the river--and it is the greatest device for getting water into the soil and conserving it there, a critically important device in low moisture areas, and an important, though not usually critical one in the humid East. It has other values, too.

Nichols, M. L., Reed, I. F., and Reaves, C. A. SOIL REACTION: TO PLOW SHARE DESIGN. Agr. Engin. 39: 336-339. June 1958.

A study of the basic effects of variations in plow share design on the total draft of the plow with special attention to the adhesion of sticky soils shows that the cutting edge of the share exerts material effect on the entire behavior of the plow. Any beveling or increase of approach angle for the surface at the edge of the share affects the soil movement and exerts an increased pressure on the soil which in turn increases draft and deflects soil moving over the share and moldboard, materially affecting scouring. A worn plow share vectored pressure downward with an increased tendency to produce a compact plow sole.

Pendleton, J. W. EFFECT OF CLOVER, ROW SPACING, AND RATE OF PLANTING ON SPRING OAT YIELDS. Agron. Jour. 49: 555-558. 1957.

A red clover interseeding reduced spring oat yields but increased the test weight. Reductions in oat yields due to the presence of clover increased as oat row width increased. Grain yields and test weights were reduced as the row width of oats increased and seeding rate decreased. The importance of cultural practices in increasing a small amount of seed of a new oat variety is discussed.

Strickler, P. E., and Phillips, H. C. HARVESTING HAY AND STRAW. ARS 43-27, U. S. Dept. Agr. Agr. Res. Serv. May 1956.

This report presents information on the methods used in harvesting hay and straw over a period of 16 years when important changes in harvesting were taking place.

Taylor, G. S., and Johnson, W. H. TILLAGE STUDIES WITH CORN ON AN OHIO LAKEBED CLAY SOIL. Soil Sci. Soc. Amer. Proc. 20: 274-278. 1956.

A 3-year tillage study with corn was conducted on Hoytville silty clay, an extensive soil in the glacial lakebed which covers portions of Ohio, Indiana, and Michigan. The treatments were fall plowing, spring plowing at shallow and normal plow depths, spring plowing of wet soils, and surface tillage after spring plowing which gave two degrees of seedbed "fineness".

Treatment brought about a wide range of surface conditions on plots following alfalfa or corn. Fall and shallow plowing have usually resulted in fine seedbed and in rapid emergence. Coarse seedbeds and less rapid emergence were obtained by spring plowing at normal plow depths. Shallow and wet plowing resulted in lowest soil moisture contents. The treatments resulted in significant differences in soil porosities and nitrogen contents following alfalfa but not following corn. Following alfalfa, spring plowing at normal plow depths brought about highest soil porosities and greatest leaf nitrogen contents; while fall, wet, and shallow plowing were associated with lower porosities and nitrogen. The treatments had no effect on phosphorus contents and affected potassium contents only during a drouthy season.

Corn yields were reduced during a drouthy season by spring plowing with maximum seedbed fitting, and by shallow and wet plowing. Lowest yields were obtained from the treatments which result in lowest soil moisture contents. There were no significant yield differences during 2 years of better rainfall distribution.

Woodward, R. W. THE EFFECT OF RATE AND DATE OF SEEDING OF SMALL GRAINS ON YIELDS. Agron. Jour. 48(4): 160-162. April 1956.

On irrigated soil in Western United States, barley sown at rates of 30 to 40 pounds per acre yielded as well as at higher rates up to 140 pounds per acre. Rates of 50 to 60 pounds were adequate for other grains except when sown late. Lighter rates produced stiffer straw, larger heads and kernels, and higher test weight per bushel than the heavier rates. At late planting dates, higher rates helped control weeds and disease. Use of high grade, certified seed is urged for higher yields at lower rates.

CROPS

General

French, B. L. FUNCTIONAL RELATIONSHIPS FOR IRRIGATED CORN RESPONSE TO NITROGEN. Jour. Farm Econ. 38: 736-747. Aug. 1956.

By using data from three experiments designed to study the application of nitrogen fertilizer to irrigated corn in the Western States, comparisons were made among estimates obtained from five mathematical functions fitted to the data. A form of the exponential ($Y = M - AR^X$) and the "quadratic-square-root" form ($Y = a + b_1 \sqrt{x} + b_2 X$) of the general quadratic were better fits to the experimental data than the Cobb-Douglas, or quadratic form. Little evidence was found for a preference between the two mathematical functions based on data covering the full range of the experiments. A preference for one versus the other might be based on the computational complexity. To obtain least-squares estimates of the parameters in the exponential function, an estimate must be made of R. By several iterations this value is adjusted until the least-squares estimates are obtained. For the quadratic square root function, the direct method of least-squares multiple regression estimation is available, and only a single series of computations is needed. Evidence showed that fewer than 12 rates of application may be applied. Not less than 5 or 6 should be applied for a single input factor, with a minimum of 3 replications, and so distributed over a range of rates that little increase in experimental yields at the higher rates of application will be obtained. A few exploratory experiments may be needed to determine the proper range.

Grafius, J. E. THE RELATIONSHIP OF STAND TO PANICLES PER PLANT AND PER UNIT AREA IN OATS. Agron. Jour. 48: 460-462. 1956.

The relationship between stand and panicles per plant and per unit area was explored. Two theories were developed and proved and used as a basis for calculating the theoretical effect of variations in stand on number of panicles per unit area. As would be expected, some of the 40 varieties of oats tested compensate better than others for variations in density of stand.

Robins, J. S., and Domingo, C. E. POTATO YIELD AND TUBER SHAPE AS AFFECTED BY SEVERE SOIL-MOISTURE DEFICITS AND PLANT SPACING. Agron. Jour. 48: 488-492. 1956.

Total and U. S. No. 1 grade yield of Russet Burbank variety potatoes was reduced up to 30% and 58%, respectively, by soil-moisture stress. Spindled tubers resulted from stress at any time following tuber initiation. Location and intensity of the growth construction corresponded to the time and intensity of the imposed stress. Late-season stress hastened maturity and reduced growth cracking whereas mid-season stress increased growth cracking. Knobby second-growth was essentially independent of moisture in these experiments.

Reduced stem populations resulted in a lower yield and number of tubers and a higher percentage of tubers with knobby second-growth and growth cracks.

Smith, Dale. INFLUENCE OF FALL CUTTING IN THE SEEDING YEAR ON THE DRY MATTER AND NITROGEN YIELDS OF LEGUMES. Agron. Jour. 48(5): 236-239. May 1956.

At Madison, Wisconsin, in 1951 and 1952, cutting-top growth in September and October reduced the dry matter and nitrogen yield in the fall of the seeding year from alfalfa, red clover, and alsike clover. Reduction was especially marked in 1952 for alfalfa straws which were weakened by crown and root rot. Largest reductions from fall cutting were with the Arizona alfalfa.

Field Crops

Andrew, R. H., Ferwerda, F. P., and Strommer, A. M. MATURATION AND YIELD OF CORN AS INFLUENCED BY CLIMATE AND PRODUCTION TECHNIQUE. Agron. Jour. 48(5): 231-236. May 1956.

Yield comparisons of two corn hybrids, W_{240} and W_{255}, grown at Wageningen, Netherlands, and Spooner, Wisconsin, showed maximum yields averaging 110 bushels per acre at Wageningen and 68 at Spooner, Wisconsin: 5-year averages for W_{240} were 86.1 and 62.9, respectively. Higher plant populations (28,907 per acre at Wageningen, 11,784 in Wisconsin), uniform rainfall distribution, higher soil fertility, and lower disease incidence contributed to high yields at Wageningen. The stage of maximum maturity required up to 9 more weeks growing season and occurred as much as 6 weeks later at Wageningen than at Spooner.

Burleson, C. A., and Cowley, W. R. COTTON HARVEST-AID CHEMICAL TESTS IN TEXAS, 1955. Prog. Report 1855. Tex. Agr. Expt. Sta., Mar. 6, 1956.

Magnesium chlorate and sodium chlorate-borate compounds gave the most consistent and best general defoliation; these compounds in combination with amino triazole usually gave excellent defoliation and regrowth control in South Texas. Amino triazole alone, at 1.5 to 2.0 pounds per acre, gave acceptable defoliation in South Texas on open-bolled varieties.

Under conditions of high soil moisture and humidity and lower temperatures this season in the Blackland and Grand Prairies, usually two applications of a desiccant were required for satisfactory stripping. 2,4-D added to pentachlorophenol increased drying and retarded regrowth, but reduced seed germination and seedling stand in some tests. Defoliants generally did not give satisfactory results for stripping.

Larson, W. E., and Willis, W. O. LIGHT, SOIL TEMPERATURE, SOIL MOISTURE AND ALFALFA-RED CLOVER DISTRIBUTION BETWEEN CORN ROWS OF VARIOUS SPACINGS AND ROW DIRECTIONS. Agron. Jour. 49: 422-426. 1957.

Alfalfa-red clover stands and growth frequently were poorer in a band at the south side of 80-inch spaced east-west planted corn rows than in the remainder of the interspace between the rows. Stands between north-south corn rows were usually more uniform. The band of poor stand on the south side of east-west rows coincided with a band of soil receiving near full sunlight throughout the day. This resulted in higher soil temperature and frequently lower soil moisture.

Ramig, R. E., and Koehler, F. E. HIGH WINTER WHEAT YIELDS. Nebr. Expt. Sta. Quarterly, Nebr. Agr. Expt. Sta., Winter-Spring 1956.

Average wheat yields for the six-year period were 26.2 bushels per acre following burning and plowing; 24.8 bushels after plowing; 25.7 bushels after one-way disking; and 27.4 bushels after subtilling. In four of the six years, yields were highest after either one-way disking or subtilling. In 1951 and 1954 burning and plowing gave the best results.

Russell, M. B., and Danielson, R. E. TIME AND DEPTH PATTERNS OF WATER BY CORN. Agron. Jour. 48(4): 163-165. April 1956.

Corn utilized water at a depth of 5 feet or more in a deep Brunizem soil. In each of three widely different moisture regimes, total water disappearance was proportional to corn yield. Rainfall and irrigation affected the soil moisture profile to a depth of only 2 feet on both corn and fallow plots.

Wiggans, S. C., and Frey, K. J. TILLERING STUDIES IN OATS. III. EFFECT OF RATE OF PLANTING AND TEST WEIGHT. Agron. Jour. 49: 549-551. 1957.

The number of head-bearing culms per oat plant decreased as planting rate was increased. Low test weight seed produced a significantly higher number of head-bearing culms per plant than high test weight seed in 4 of the 6 varieties grown in 1955. No similar relationship existed in 1954.

Pasture and Range

Heinemann, W. W., and VanKeuren, R. W. A COMPARISON OF GRASS-LEGUME MIXTURES, LEGUMES, AND GRASS UNDER IRRIGATION AS PASTURE FOR SHEEP. Agron. Jour. 50: 189-192. 1958.

In irrigated pasture studies with sheep, alfalfa and orchardgrass-alfalfa produced the highest liveweight gains per acre. The average daily gains were higher on legumes and orchardgrass-legume mixtures than on orchardgrass alone. The ability of alfalfa to persist under grazing was shown by the excellent stands of this legume at the end of 3 years of grazing.

Miller, R. K. CONTROL OF HALOGETON IN NEVADA BY RANGE SEEDLINGS AND HERBICIDES. Jour. Range Mgt. 9: 227-229. 1956.

Spraying halogeton with 2,4-D did not completely eliminate halogeton. Best results were obtained where halogeton was sprayed prior to flowering and where the herbicide reached the lower portions of the plant. Fall grazing of sheep on halogeton sprayed with 2,4-D in diesel fuel was no more dangerous than grazing in a non-sprayed area. Halogeton and crested wheatgrass occur in inverse proportions. Therefore, if sufficient wheat grass is present, halogeton will be scanty or absent. Large, vigorous grass plants strongly compete with halogeton plants.

Forestry, Woodlots, Shelterbelts

Alvord, B. F. MARKETING CHRISTMAS TREES IN ALABAMA. Ala. Polytechnic Inst. Agr. Expt. Sta. Bul. 309. Oct. 1957.

There seems little doubt that the Christmas tree business justifies further attention by potential producers of trees. In Alabama alone it may, at reported prices, represent about a million dollar business at retail and half that amount at wholesale.

The potential demand for quality, locally produced trees (well-shaped, full, good color, and without substantial deformities or defects) is good. It appears to exceed the current supply of such trees at prices comparable with those of trees of similar height from distant sources.

Bell, J. F., and Helland, M. L. COMBINING TWO SPECIES WITH DIFFERENT ROTATIONAL AGES IN DETERMINING THE ALLOWABLE ANNUAL CUT. Jour. Forestry 55: 351-353. 1957.

This is a brief summary of the way in which the allowable annual cut is calculated for two species with different rotational ages by combining them in the final step of the area regulation method.

Clark, F. B., and Liming, F. G. LOW-GRADE HARDWOOD STANDS IN THE MISSOURI OZARKS RESPOND TO STAND IMPROVEMENT. Jour. Forestry 55: 354-358. 1957.

Although the unthinned stands did not appear overcrowded, the basal-area growth rate indicates that the stocking for stands similar to those studied should be something less than 90 square feet basal area per acre if maximum basal-area growth is desired. Basal-area growth is just one of many things which must be considered in determining the optimum stocking of a stand at a given age.

Derr, H. J. EFFECTS OF SITE TREATMENT, FERTILIZATION, AND BROWNSPOT CONTROL ON PLANTED LONGLEAF PINE. Jour. Forestry 55: 364-367. 1957.

In a study in central Louisiana, pre-planting site treatments had little or no effect on either survival or early growth of planted longleaf pine. Site treatments, including furrowing, disking, burning, followed by disking and burning alone, were applied.

Spraying the seedlings with Bordeaux controlled the brownspot needle blight and thereby improved growth significantly in four years. Fertilizer applied during planting reduced survival significantly and failed to improve growth except on furrowed plots where competition was most effectively removed.

Gilmore, A. R., and Livingston, K. W. CULTIVATING AND FERTILIZING A SLASH PINE PLANTATION: EFFECTS ON VOLUME AND FUSIFORM RUST. Jour. Forestry 56: 481-483. 1958.

In an old-field plantation of slash pine, cultivation and light applications of NPK fertilizer during each of the first three growing seasons resulted in an apparent but not significant increase in pulpwood volume of about 10 percent after 19 growing seasons. There was a significant increase in number of trees with stem cankers of southern fusiform rust on cultivated and fertilized areas. Growing crops of cotton between the tree rows with additional, somewhat heavier fertilizer applications resulted in a further nonsignificant volume increase of about 10 percent without a further increase in stem cankering. A significant difference of about 21 percent was found between the volume of the control plots and the volume of the highest fertilized plots.

Whether nutrient elements added in fertilization were still present in the nutrient cycle of the stands was not clearly demonstrated. However, the amount of phosphorus found in both soil and litter was least on control plots and greatest on plots to which the most fertilizer had been added.

Hansen, N. J., and McComb, A. L. GROWTH OF PLANTED GREEN ASH, BLACK WALNUT, AND OTHER SPECIES IN RELATION TO OBSERVABLE SOIL-SITE CHARACTERISTICS IN SOUTHEASTERN IOWA. Jour. Forestry 56: 473-480. 1958.

During the period 1938-1941, coniferous and broadleaf species were established by the Civilian Conservation Corps in plantations on old-field sites in the Weller-Lindley soil association area of southeastern Iowa. Most of the soils belong to the gray-brown podzolic great soil group. They are formed from loess and glacial till, are old, highly weathered, and usually have a fine-textured B-horizon (claypan) at 12 to 24 inches from the surface. On flatter upland ridges, terraces, and some bottomlands there are planosols which, because of relatively impervious claypans, are very poorly drained and aerated during periods of high rainfall. The surface layers of these soils are mostly loam or silt loam, and the B-horizons are clay loams or silty clays. The site index of oak commonly ranges from 45 to 55.

Growth and survival of plantation trees were studied in this area. With green ash, black walnut, and other species distributed over a variety of sites, an attempt was made to correlate growth with easily observable soil-site characteristics. The growth of the broad-leaves is compared with that of pines planted on similar sites.

The principal results of this study are:

1. Pine species have been growing satisfactorily for 18 years and are beginning to produce merchantable wood products. In contrast, most broadleaf species could not be expected to produce merchantable material.
2. Height and diameter growth of ash were inversely correlated with the degree of erosion of the A-horizon.
3. On uneroded areas there was great variation in growth of ash. On these sites height growth was directly correlated with leaflet nitrogen, and high nitrogen and good growth were obtained on previously uncultivated soils.
4. An empirical method of predicting early height growth of green ash in the Weller-Lindley area, based on numerical ratings of seven site factors, was developed. The factors used were degree of erosion, depth to subsoil of low permeability, great soil group, color of surface soil, aspect, degree of exposure, and past land use.
5. The growth of black walnut was significantly correlated with (1) the texture and depth of the rooting zone, (2) presence of mottling and iron concretions indicative of internal drainage and aeration, and (3) color of the surface layers as indicative of the content of organic matter and possibly the supply of plant nutrients. In all cases the correlation coefficients were low and it was not possible to predict walnut growth on the basis of easily observable site factors.

Economics of Conservation

Alleger, D. E. RURAL FARM RETIREMENT. A STUDY OF RURAL RETIREMENT IN FIVE FLORIDA COUNTIES. Fla. Agr. Expt. Sta. Bul. 583, 51 pp. illus. Feb. 1957.

Of 192 field interview records taken during 1952 and 1953 from rural retirement farm families, 175 were analyzed. Only 68 of the family heads were native Floridians. Two-thirds of the families consisted of 2 persons, usually husband and wife. The average retiree was between 69 and 70 years of age; his formal education approximated the seventh grade level; his annual retirement income was $974, and his annual cash needs $1,164. His farm, usually personally owned, was valued at nearly $5,300. Disability (76 percent of the family heads were disabled) tended to increase with age. The approximately one-third who had been farmers before retirement usually had the lowest retirement incomes and were most disadvantaged so far as levels of living were concerned. Retirees farmed either for economic reasons or for personal satisfaction, or both. Net farm earnings averaged $212 from an average of just over 2 cultivated acres. Usually, earnings were about sufficient to bridge the gap between retirement income and cash requirements. This was not true for the lowest third ranked according to retirement income. Retirement income and age were found to be inversely related to net farm earnings. Direct relationships existed between net farm earnings and experience in agriculture.

The data indicated that persons retiring at age 65 may expect only a limited period of farming activity, provided they supply most of their own farm labor. The average retirement farm family needed just over $100 a month for cash living expenses.

Anderson, H. O., McNall, P. E., and Inman, B. T. PROGRESS IN APPLICATION OF SOIL-CONSERVING PRACTICES, SOUTHWESTERN WISCONSIN. U. S. Agr. Res. Serv. ARS 43-44, 38 pp., illus. April 1957.

Concerted action to obtain adequate soil conservation in this area was begun in 1940 through the establishment of a soil conservation district in each of 5 counties. After 15 years 45 percent of the farmers were cooperating in the program. A study was made in 1955 of 127 farms in Sauk, Richland, Juneau, Vernon, and Monroe counties--to learn what progress farmers had made in carrying out soil conservation programs for their farms and the effects of the programs on farm production and income. The farms, which were grouped into high-, medium-, and low-conservation farms, had been operating under soil-conserving plans for averages of 10, 8, and 5 years for the 3 groups, respectively. Such practices as use of contour strips, terraces, and diversions were given the highest ratings as conservation measures by the farmers. Low-conservation farmers favored vegetative cover and use of lime and commercial fertilizer. Lack of time was the important reason given by 17 percent of the farmers for the delay in adopting soil conservation practices; lack of capital the reason given by 35 percent. On-the-farm planning was considered necessary for adequate conservation planning. Crop yields on the high-conservation farms were 7 percent above the average of the 127 farms; those on the low-conservation farms were 10 percent below average. Pasture renovation rated lowest on the list of applied conservation practices because of lack of time, high cost, and lack of equipment. Yields of crops were 8 percent higher for each additional 3 years of conservation farming.

Baumann, R. V., Heady, E. O., and Aandhal, A. R. COSTS AND RETURNS FOR SOIL-CONSERVING SYSTEMS OF FARMING ON IDA-MONONA SOILS IN IOWA. Iowa Agr. Expt. Sta. Res. Bul. 429, 480 pp., illus. June 1955.

Changes in present systems of farming which center around grain crops and drylot fattening of cattle and hogs are necessary if farmers on these soils are to control serious gully and sheet erosion. Suggestions are: use of crop rotations that include more acres of grass and legumes; a combination of better rotations and such practices as terracing and contouring; and a combination of better rotations, mechanical erosion-control practices, and fertilizer.

The greater production of hay and pasture under each of these suggested systems would favor a livestock system of farming. The change from present to alternative systems would be profitable. Compared with a net farm income of about $1,318 at 1940-44, prices from an exploitive cash-grain system would return $1,918; a hog-beef-raising system, about $3,158; a system including hogs and yearling steers wintered, pastured and fed grain in drylot, about $3,219; and a hog-dairy system, about $3,271. With a higher price level, that of 1953, for example, net farm incomes would be greater.

But the larger incomes would not be forthcoming immediately; for a year or two in the transition period incomes would be lower than with present systems of farming.

Bird, R., Miller, F., and Turner, S. C. RESOURCES AND LEVELS OF INCOME OF FARM AND RURAL NONFARM HOUSEHOLDS IN EASTERN OZARKS OF MISSOURI. Mo. Agr. Expt. Sta. Res. Bul. 661, 71 pp., illus. Mar. 1958.

Analysis of the records of 785 open-country households showed that 32 percent of the farm families and 27 percent of the rural nonfarm households had incomes of less than $1,000 in 1955. Only 22 percent of the incomes of farm households with less than $1,000 came from farming--2 percent came from work on other farms; 31 percent from nonemployment sources; and 45 percent from nonfarm employment. An apparent reason for low income was the limited ability of the family head to work because of age or disability. Most of the farms were too small to provide a satisfactory level of income under the present organization. More than 87 percent of the farms had gross sales of less than

$2,500 in 1954. Many of the nonfarmers living in the open country had inadequate incomes. About 27 percent of them had incomes of less than $1,000. Of the heads of these households, 84 percent were either over 58, females, or unable to work. The 1954 census classified about 60 percent of all farms in the area as part-time or residential units. Data obtained in the survey indicated that only 7 percent of the household incomes of people who operated these units were derived from farming. Two reasons were found for low incomes of some of the commercial farmers in the area--the advanced age of the operators, and the small size of the farm businesses. Most farms lack the resources to provide either full employment for a normal family labor force or satisfactory levels of income. If farms in the area are to return adequate incomes, consolidation of these units or the addition of such intensive enterprises as poultry, livestock, and horticultural crops will be necessary.

Burch, T. A., and Butler, C. P. ECONOMIC ANALYSIS OF ANNUAL ADJUSTMENTS IN DEVELOPING A GRADE A DAIRY IN THE PIEDMONT AREA OF SOUTH CAROLINA. S. C. Agr. Expt. Sta. Bul. 442, 57 pp., illus. Mar. 1957.

In this area dairying appears to be a profitable alternative for some of the medium-sized, low-income cotton farms that contain from 50 to 150 acres of open land and as now operated are inadequate to furnish even a minimum level of living. Prospective demand for milk, based on growth in population and increased per capita consumption, indicates a need for future increases in milk production. In developing a grade A dairy enterprise on a representative cotton farm with about the same level of living as in 1954, 7 years would be needed to liquidate the debts for the additional investment required. This is discouraging, especially to operators who are over 50. However, capital could be accumulated at a relatively fast rate and after the 7 years of adjustment, net cash receipts would be about $8,900. Net returns to the operator for his labor and management, at prices slightly lower than those of 1954, would be approximately $7,000. The key to success in carrying out the adjustments outlined in the analysis for a representative cotton farm is good management.

Butler, C. P., and Lanham, W. J. AN ECONOMIC APPRAISAL OF THE CONSERVATION RESERVE PROGRAM IN AREA IIIB, UPPER COASTAL PLAIN OF SOUTH CAROLINA. S. C. Agr. Expt. Sta., Dept. Agr. Econ. AE 135, 59 pp., illus. Feb. 1958.

Included in the study were 147 participating and 159 nonparticipating farmers. By using farm budgets for representatives farms in each size group of participant farms, net cash receipts were computed for 1957 actual participation in the Soil Bank, for no participation in the Soil Bank, and for all eligible acreage in the soil Bank. In all size groups, an increase in net cash receipts, labor costs included, is revealed where partial or entire acreages were placed in the Soil Bank program. A direct relationship was found between acreage placed in the Soil Bank and net cash receipts when labor costs are included. With labor costs excluded, data for all size groups show increased net cash receipts when there is no participation in the Soil Bank. Operators of small farms who use family labor in their farm operations would forego a sizable amount of farm income by participation. This would apply, also, although to a lesser extent, to operators of medium-sized farms. Operators of large farms, who use more hired than family labor, would find it desirable to place a part or all of their eligible acreages in the Soil Bank. The major problem in the area was not the adequacy or inadequacy of payment rates but the large number of small farms. If they are to participate in the program, operators of these small farms must find part-time or full-time nonfarm jobs to offset the reduction of net cash receipts resulting from participation.

Case, B. A. FARM-MORTGAGE LOANS HELD BY LIFE INSURANCE COMPANIES. U. S. Agr. Res. Serv. ARS 43-58, 39 pp., illus. Oct. 1957.

Basic information for this study was obtained from 17 life insurance companies on farm-mortgage loans outstanding June 30, 1956. These companies held 87 percent of the amount of farm-mortgage debt held by all life insurance companies on January 1, 1956.

In 1951-52, life insurance companies made 8 percent of their loans for $25,000 or more; in 1955-56, the proportion was 15 percent, with the increase in size of loan most noticeable in the Pacific States. The average loan in the United States as a whole was $13,400. The average amount outstanding on June 30, 1956, was $10,800.

On loans made before 1950 and still outstanding June 30, 1956, more than a third of the debt has been repaid. The average term for all loans is 18.7 years. Of the loans outstanding on June 30, 1956, 69 percent had terms of 16 to 20 years. The average interest rate for loans outstanding on June 30, 1956, was 4.52 percent. More than half of the loans made since 1950 have interest rates of 4.50 percent. Differences in loan characteristics by companies reflect mainly the policies of individual companies and the regions in which they operate.

Foreman, W. J. RESOURCE RETURNS AND PRODUCTIVITY COEFFICIENTS ON OWNER-OPERATED FARMS IN THE PIEDMONT OF GEORGIA. Ga. Agr. Expt. Sta. Tech. Bull. N. S. 9. Dec. 1956.

The gross incomes and resource use patterns of 250 owner-operated farms in the Georgia Piedmont were analyzed for 1952, by using Cobb-Douglas production functions, to determine the elasticity of coefficients of production and the marginal return to: (1) each acre of land of all kinds in the farm, (2) each "man-month equivalent" of either family or hired labor, (3) each dollar invested in farm machinery, (4) each dollar invested in livestock or forage production, and (5) each dollar of current operating capital employed on the farm.

The production function for the 250 farms was:

$$Y = 4.71\, X_1^{0.1303}\, X_2^{0.0417}\, X_4^{-0.0831}\, X_5^{0.8128},$$

where Y is gross farm income in dollars, X_1 is the number of acres of land in the farm, X_2 is the number of months of labor used, X_3 is the machinery and equipment investment in dollars, X_4 is the livestock and forage investment in dollars, and X_5 measures current operating capital used in dollars. All of the productivity coefficients (i. e., the exponents in the function above) were significant at the five-percent level or above except that for machinery. Separate functions were computed for each of four county subareas in the Piedmont sample and for four groups of farms by type. Only current operating capital showed consistently significant elasticities of production when the farms were analyzed in smaller groups. These elasticities were all significant at the one-percent level.

Returns to scale were found to be essentially constant for Piedmont farms as a whole and for each of the sub-groups except Wilkes County. Returns there were found to be increasing significantly with scale, as sum of elasticities was significantly greater than 1.0 at the five-percent probability level.

Garlock, F. L., and Becker, R. J. FINANCING BROILER PRODUCTION BY BANKS AND PRODUCTION CREDIT ASSOCIATIONS IN THE SOUTH. Southern Coop. Ser. Bul. 44. June 1955.

These studies of banks and production credit associations were made in Georgia, Mississippi, South Carolina, and Virginia in the spring and summer of 1953. Data were on numbers of borrowers as follows: 245 growers, 33 feed dealers, 15 hatcherymen, 10 feed mill operators, 7 processors, and 19 others. Growers and dealers received one-third of the amounts loaned by lending agencies to segments of the broiler industry from 1948 through the spring of 1953. From 12 to 14 percent of the capital used by growers, dealers, hatcherymen and feed mills and 33 percent of that used by processors was supplied by lending agencies. Average assets of growers ranged from about $15,000 for those whose main enterprise was growing broilers to more than $50,000 for those whose main enterprise was nonfarm. Loans to growers were used chiefly for feed and chicks. The security required varied with the purposes for which the loans were used. About a fourth of those made mainly for chicks and feed were unsecured. Interest rates for growers ranged from less than 5.5 to more than 7.5 percent. Most rates fell between 5.5 and 6.4 percent. Forty percent of loans to growers for purchase of chicks and feed were dated to mature within 3 months and 42 percent to mature after 6 months. Nearly 60 percent were repaid within 4 months. No bank or production credit association sustained any loss on loans to growers covered by this study.

Gavett, E. E. LABOR USED FOR FRUITS AND TREE NUTS. U. S. Dept. Agr. Stat. Bul. 232, 52 pp., illus. June 1958.

The information shown in this bulletin on average man-hours used per acre in 1954 for individual fruits and tree nuts was intended to be helpful to growers in estimating needs for labor; to seasonal labor-placement supervisors in recruiting workers and in deciding on transportation and housing needs; and to researchers in making future farm-adjustment studies. Estimates of numbers of man-hours per acre include numbers of man-hours needed for direct work--preharvest and harvest (including farm grading, packing, and marketing). Requirements for indirect work--maintenance, service, etc.--are not included.

Gray, J. R. SOUTHWESTERN SHEEP RANCHES. ORGANIZATION, COSTS AND RETURNS, 1940-54. N. Mex. Agr. Expt. Sta. Res. Rept. 7, 20 pp. May 1957.

Sale of lambs constituted 38 percent of the total cash income for representative sheep ranchers in West Texas, New Mexico, and Arizona during a 17-year period ending in 1953. Wool brought in 36 percent of their income and sale of sheep other than lambs, 10 percent.

Grazing fees made up 29 percent of the cash costs, livestock purchases 21 percent, building and improvement expenditures 15 percent, and labor 13 percent. When operating conditions were favorable, net ranch income was high. In 6 of the years, operating conditions were unfavorable and in 6 additional years, they were very poor. Sheep numbers dropped from 1,425 in 1940 to 1,228 in 1956. Investment per ranch has exceeded $1000,000 since 1947. In 1952 it reached $200,000, but has since declined. Net ranch income per ranch exceeded $3,000 in 13 of the 17 years, $4,000 in 11 years, and $5,000 in 7 years. In 1950 it amounted to more than $9,000 and in 1951, to more than $10,000. In both 1941-42 and 1949-51, prices were favorable to sheep producers. In 1945, 1952, and 1953, prices were unfavorable, although in 1945, net ranch income remained moderately high because of favorable operating conditions.

Gray, J. R., and Plath, C. V. ECONOMICS OF ADJUSTING TO DROUGHT ON EASTERN OREGON CATTLE RANCHES. Oreg. Agr. Expt. Sta. Misc. Paper 48, 44 pp. Sept. 1957.

During the drought in eastern Oregon in 1955 ranchers had to reduce their breeding herd or buy feed. The most profitable action for some was to acquire more feed by leasing additional meadowland or range. This alternative was not available to all. Others bought grain or hay. Buying hay proved to be a better choice economically.

Cash expenses either increased materially or were held about constant during the drought year compared to a pre-drought year, while production decreased substantially in 4 of the 5 groups of ranchers studied. Decreased production resulted from lighter weights of animals sold during the drought. Calf crops the year following drought were about 11 percent less than normal, but calf weights in the following year with good range conditions were normal.

The drought disaster program saved ranchers who participated 5 to 7 cents on each dollar of production costs during the drought year. Benefits of the program would have been much greater if the drought had been more severe or of longer duration.

Ranchers who were in a strong financial position during the 1955 drought were able to buy feed or acquire more range or meadow land and to continue operations. Ranchers who were in a weak financial position had no choice but to dispose of part of their breeding herds. The key difference between financial success or failure during the 1955 drought in eastern Oregon was not management of the breeding herd, but management of the feed supply.

Gregory, W. F. SILAGE MAKING: COSTS AND PRACTICES. REPORT OF A 1954-55 STUDY OF EXPERIENCES OF FARMERS IN FOUR ALABAMA COUNTIES. Ala. Agr. Expt. Sta. Bul. 310, 29 pp., illus. Dec. 1957.

For farms in the study, the average cost of harvesting, storing, and feeding a ton of silage was $3.93 for trench silos and $5.18 for upright silos. The average cost per ton of harvesting and putting silage in trenches varied from $2.12 when field forage harvesters were used to $2.82 when mowers were used. With binders, the cost was $2.73 per ton. Costs of harvesting and storing silage in upright silos averaged $2.70 with field forage harvesters and $2.94 with binders. Fewer men and machines were needed with field forage harvesters--an average of 4.6 men was used when silage was cut by this method and placed in trenches compared with an average of 5.1 men when silage was stored in upright silos. With binders, the crew averaged 7 and 11 men for silage stored in trench and upright silos, respectively. Labor and machine costs averaged more than $7 per hour, although the machines were idle for an average of 20 percent of the time. Harvesting costs made up more than 60 percent of the total costs (including feeding) for both trench and upright silos. Storage costs were 7 percent of all costs for trenches, but 15 percent for upright silos. Feeding costs were 31 percent with trench silos and only 19 percent with upright silos. The initial construction costs were greater for upright than for trench silos, but direct annual costs were greater for trenches. Total storage costs per ton were $0.27 for trench silos and $0.78 for uprights. Spoilage amounted to 5.7 and 2.5 percent for trench and upright silos, respectively. Feeding costs were $0.96 per ton from upright and $1.23 per ton from trench silos.

Hansing, F. D. FINANCING THE PRODUCTION OF BROILERS IN LOWER DELAWARE. Del. Agr. Expt. Sta. Bul. 322. Oct. 1957.

In 1955 about two-thirds of the broilers grown in Lower Delaware were produced under contracts with feed dealers. Only 6 percent were grown by independent growers. Feed growers who contracted with growers produced on their own account about 18 percent of the broilers. The remaining 10 percent were produced by noncontracting dealers. Contracts under which more than 70 percent of the broilers were produced guaranteed the growers a return for their labor and their investment in broiler housing. Less than 30 percent were produced on share plans with no guaranteed returns. For the most part, contract growers produced broilers on a relatively small scale. They had relatively small net worths. Independent growers had larger net worths and produced on a larger scale.

Slightly more than half the growers in the State in 1955 were full-time farmers. Others included part-time farmers, retired persons, and nonfarmers. The average outstanding investment in chicks on feed in Lower Delaware in 1955 was estimated to be about $5.5 million. Nearly 85 percent of this investment was made by contracting dealers who provided the chicks, feed, and other supplies needed by contract farmers, as well as those required for their own production. It appears that about 20 to 25 percent of the total investment in chicks or feed was financed through credit extended by feed manufacturers and other suppliers; that about 20 to 25 percent was financed through loans obtained by dealers and independent growers; that 50 to 60 percent of the investment was supplied by dealers and independent growers from their own funds. Policies and methods of lending institutions apparently are not responsible to any considerable extent for the prevalence of contract growing. Most growers preferred to grow broilers under contract because this arrangement limited the risks they assumed.

Hughes, W. F. COSTS AND RETURNS OR IRRIGATED PEANUT PRODUCTION IN THE WEST CROSS TIMBERS TEXAS, 1953-54. Tex. Agr. Expt. Sta. Prog. Rpt. 1759. Mar. 1955.

This report is based on the irrigation experience of 6 farmers in the Highlands area of Comanche and Erath Counties in 1953 and 1954. Costs and returns for irrigated peanut production reflect neither the total cost of production nor the total return per acre for irrigated peanuts. The costs are above those of nonirrigated peanut production on the same farm. The returns reflect the value of the production increases attributable to irrigation less the costs of production. Irrigation costs varied widely. In 1953, the actual cash costs of irrigation were 16 to 35 percent of the total irrigation costs; in 1954, these costs ranged from 19 to 37 percent. The 2 years of irrigation experience summarized here do not cover a sufficient period of time to permit an appraisal of the long-run effects of irrigation or of the potential life of the water supplies.

Hutton, R. F., King, G. A., and Boucher, R. V. A LEAST-COST BROILER FEED FORMULA. METHOD OF DERIVATION. U. S. Dept. Agr. Prod. Res. Rept. 20, 39 pp. May 1958.

This report describes the linear programming model used in deriving a least-cost broiler-feed formula that will meet each of a number of stated specifications, and gives the reasoning back of the development and application of the formula. The important nutrient specifications of broiler rations relate to levels of protein, fiber, productive energy, amino acids, minerals, vitamins, and several unidentified factors. In addition, rations usually contain small amounts of antibiotics and antioxidants. A set of nutritive and other specifications of broiler feeds, including restrictions as to minimum and maximum amounts of the several ingredients that make up the ration, is outlined. Composition tables bring together the latest available information on the nutrient composition of the feedstuffs considered in the analysis. A solution for a realistic broiler feed problem under actual price conditions is developed for a given time and place. Methods are outlined for adjusting the formula to changes in prices, changes in ration specifications, and changes in composition of ingredients. Certain of the specifications--salt, for example--can be met from only one source. For cetain others, the least-cost source can be predetermined. The total problem is simplified by adding the ingredients in these two catagories in fixed amounts and eliminating them from the main analysis.

Ibach, D. B., and Mendum, S. W. A SIMULTANEOUS SOLUTION FOR THE EXPONENTIAL YIELD EQUATION. Jour. Farm Econ. 40(2): 469-476, illus. May 1958.

Procedures recently developed permit reflection of all reported observations in a factorial experiment when the exponential function for economic analysis of a fertilizer production surface is used. Previous work has illustrated use of this equation for one independent variable. Exact values of the parameters for one independent variable can be determined by methods previously shown. But all previous published work with the exponential equation has been limited to its use when parameters applicable to a nutrient were based in response at selected levels of the other nutrients.

This paper presents methods for evaluating the parameters when all nutrients experimentally applied are free to vary. Graphic determination of the parameters of the exponential yield curve is adequate for estimating yields for a production surface from responses indicated by the main effect of each of two or more nutrients in rate experiments.

The practical sufficiency of the parameters graphically determined is demonstrated by comparisons with parameters reached by an iterative complete solution. Noticeable differences in values of parameters and in results of satisfaction tests in the case of the corn experiment did not affect results used as a basis for recommended fertilizer practice.

Magee, A. C., and Rogers, R. H. FINANCING A BEEF CATTLE ENTERPRISE ON BLACKLAND FARMS. Tex. Agr. Expt. Sta. Bul. 862, 11 pp., illus. May 1957.

Results of a study of 23 farms in Bell and McLennan Counties in 1952-54 indicated that at 1956 costs and market prices a well-managed beef herd might well be a good investment on Blackland farms. With 1953 prices, 12 beef cows would pay for themselves in 4 to 7-1/2 years. At 1956 prices, 4 to 9 years would be necessary. If calves were sold without grain feeding, beef earnings at 1953 prices for 7-1/2 years would be needed to pay the cost of the breeding herd. With 1956 prices, 9 years would be required. Beef earnings for an additional 2 to 3-1/2 years would be needed at 1953 prices to pay back the average investment cost for extra fencing, shelter, feed storage, and water supplies needed to keep cows on the farms studied. With 1956 prices, 3 or 4 years would be needed. Total investment repayment periods, therefore, under 1953 and 1956 price relationships, respectively, would be: Calves fed on grain, 11 and 13 years; calves creep-fed, 6 and 7 years; calves fed in drylot, 6-1/2 and 8 years. With a grazing program featuring steers rather than cows, earnings from 30 to 50 steer calves would make the enterprise self-liquidating in 2 to 4 years at 1953 prices, depending on the grazing period. Feeders in drylot would pay off in 4 years, including the cost of needed improvements. At 1956 prices, 2 to 4 years would be needed under a grazing program, and 8 years for drylot feeding.

Magee, A. C., and Rogers, R. H. PRODUCTION AND PRODUCTION REQUIREMENTS OF CROPS--BLACKLAND AND GRAND PRAIRIES. Tex. Agr. Expt. Sta. Misc. Pub. 224, 16 pp. Sept. 1957.

Information was obtained from approximately 100 farmers in Bell, McLennan, Hill, Coryell, and Bosque Counties over a 3-year period. Blackland soils and the deeper, more productive Grand Prairie soils were devoted mainly to cash crops. For years, cotton accounted for about 90 percent of the cash farm income. Soil management on these farms has been improved by including close-seeded grains, legumes, and grasses in the cropping system. Small grain (particularly oats) and grain sorghum are now grown, and the acreage of clover has been increased. But cotton is still the chief cash crop.

Waterways have been sodded and low-producing land has been shifted to permanent grass. Very little fertilizer is used. Insecticides are used with cotton. Irrigation is not extensive and is limited to the alluvium of creeks and rivers.

Family labor is used in growing all crops, with extra labor hired for cotton hoeing and for hand harvesting the part of the cotton crop that is harvested in this way. The trend is toward the use of 4-row tractor equipment. Sesame has been suggested as a new crop for the dark, heavy soils of central Texas and a limited acreage is grown. Bermuda grass and K. R. Bluestem are commonly used in sodding waterways and establishing permanent pastures.

Magee, A. C., Stone, B. H., and Rogers, R. H. DAIRY PASTURE IMPROVEMENT PRACTICES AND COSTS. Tex. Agr. Expt. Sta. Prog. Rept. 1839, 5 pp. Jan. 1956.

In 1954 in east Texas, the 4 highest yielding permanent pastures included in a study of pasture-improvement practices on 36 dairy farms in 8 counties furnished 170 days of grazing per acre. Unimproved pastures furnished an average of only 50 days. Highest yields were obtained from pastures on which there had been a 4-year improvement program, for which the total cost averaged about $16 per acre annually. Intermediate yielding permanent pastures (106 grazing days per acre) were developed by 25 dairymen at a cost of around $8 per acre annually from 1952 to 1954. The 7 lowest yielding improved pastures furnished only 70 days of grazing per acre and were developed at a cost of around $4 per acre annually. For each $100 invested in pasture improvement, farmers with highest yielding pastures obtained 770 days of additional grazing; those with intermediate and lowest yielding improved pastures averaged 660 and 495 additional days, respectively.

Magee, A. C., Stone, B. H., and Rogers, R. H. LABOR REQUIREMENTS FOR DAIRY HERDS IN EAST TEXAS. Tex. Agr. Expt. Sta. Prog. Rpt. 1845, 3 pp. Feb. 1956.

Dairymen who milked an average of 16 cows throughout the year averaged 94 hours of labor per cow annually in looking after the dairy herd. Those who milked twice this number of cows realized a saving of 20 percent in the time spent per cow. With 64 cows milked, labor requirements dropped to 51 hours. The amount of work required to produce 100 pounds of milk varied from 1 hour for those milking 64 cows to 1.9 hours for milking 16 cows.

McArthur, W. C., and Carreker, J. R. ECONOMIC ANALYSIS OF CONSERVATION FARMING ON A COTTON-DAIRY FARM IN THE PIEDMONT AREA OF GEORGIA. Ga. Agr. Expt. Sta. Bul. N.S. 51, 45 pp., illus. Mar. 1958.

The use of resources in and income from selected soil-conserving systems of farming as followed on an experimental farm-management unit from 1944 to 1955 were evaluated. The 80 acres of open land were relatively low in productivity because of past cropping practices and erosion. Three cropping plans were developed. The first included (1) continuous corn on the most nearly level field; (2) a 4-year rotation with 2 years of cotton or corn and 2 years of small grain and annual lespedeza on gently sloping areas; and (3) a 3-year rotation with one year of row crops, 2 years of small grain, and annual lespedeza on moderately sloping areas. The second plan included (1) a 2-year cycle of row crops and wheat on moderate slopes; and (2) a 3-year cycle of row crops one year and oats-lespedeza for 2 years on the steepest slopes.

The third plan included (1) a 2-year rotation of (a) fescue grass and button clover for winter grazing, then grain sorghum for seed; and (b) volunteer grass and clover for winter grazing and green manure, then cotton or corn; and (2) a 3-year rotation of (a) oats, fescue grass, Ladino and crimson clover for seed; (b) grass and clover for summer and winter grazing; and (c) cotton or corn. The third plan was started in 1953 and was found to be the best of the three.

Net farm income varied from $1,187 in 1952 to $4,269 in 1951 and averaged $2,641 for the 12 years. Per dollar of capital investment, residual income ranged from negative values in 1952 and 1954 to 25.7 cents in 1951. During five of the years, interest or a dividend of 10 percent was earned on each dollar invested in the farm unit.

Motheral, J. R., Metzler, W. H., and Ducoff, L. J. COTTON AND MANPOWER--TEXAS HIGH PLAINS. Tex. Agr. Expt. Sta. Bul. 762. May 1953.

This study of farm labor employed in the 1951 cotton crop in Lubbock and Crosby Counties, Texas, covered the experience of 324 farm operators who were interviewed in February 1952. Information on types, sources, and utilization of labor were obtained. Large inputs of migratory manpower are needed in the area in the hoeing, chopping, and harvesting of cotton.

In recent years, progress has been made toward full mechanization of the crop, but the prevailing pattern still is once over by hand, then clean-up by machine. The type of labor used in cotton production in 1952 depended largely on whether a particular operation was handled by machine or by hand labor. Farm size was also a factor. Migratory workers accounted for about four-fifths of the hand pulling and two-fifths of the hoeing and chopping. Regular hired workers supplemented the labor of the farm family as machine operators. Local seasonal workers helped to some extent in each type of activity. Allowing for duplication in the count of workers employed on more than 1 farm, an estimated 41,000 "hoe hands" and 58,000 harvest workers were employed in the 2 counties in 1951. Labor turnover during harvest resulted mainly from dissatisfaction over wage rates or earnings. Housing, which was available on 77 percent of the farms, did not appear to be a factor. Wage rates were fairly uniform in 1951. The study showed the need for education in machine skills.

Myrick, D. C. FARM FLOCKS OF SHEEP ON IRRIGATED FARMS IN MONTANA. Mont. Agr. Expt. Sta. Bul. 512. June 1955.

The data in this report cover 72 farm flocks of sheep, with an average size of 80 ewes. However, 60 ewes represented the more typical flock, and sample budgets based on a flock of this size were prepared. The average size of the flocks studied increased by almost 11 percent during the year. Replacement lambs are not separated from the ewes during the breeding season. The average lamb crop on the farms studied amounted to 115 percent of the number of ewes to lamb. Income on these farms is sensitive to the size of the lamb crop. A 100-percent lamb crop with 60 lambs saved, 44 of which were available for sale, brought $275.40 less in net flock income than a 130-percent lamb crop with 61 lambs for sale. With a stabilized flock, it is necessary to buy only replacement rams. Wool produced averaged 10.4 pounds per ewe and yearling replacement. Wool accounts for approximately 30 percent of the income from the flock. Feed is the major item of cost in sheep farming. Other items of cost include shearing, investment costs, investment in stock sheep, and miscellaneous supplies and medicines. About the only help hired is for shearing and tagging, although in shearing, work is often exchanged with a neighbor. Costs will vary in different years and with the extent of building and new fencing added. For a flock of 60 ewes, routine care will average 456 hours a year, plus

28 hours for shearing and marketing. The net income of $622 shown for a 60-ewe flock is the return to management and labor contributed by the farmer and his family and to 15 acres of irrigated pasture.

Pond, G. A., and Nodland, T. R. THE CHANGING PICTURE OF FARMING IN SOUTHEASTERN MINNESOTA. Minn. Agr. Expt. Sta. Bul. 446 illus. Jan. 1958.

This report is based on financial and production records kept by approximately 160 farmers of southeastern Minnesota each year from 1928 to 1952. The total number of farm-year records used in the study was 3,956, supplied by 753 individuals. Dairy enterprise was the major source of income. The average size of the farms studied increased from 163 acres in 1928 to 229 acres in 1952, or 40 percent compared with an increase of 12 percent for all farms in the counties covered.

Changes shown by these farm records are the mechanization of agriculture and the substitution of mechanical power for both animal power and human energy. Even more striking are the applications of science to crop and livestock breeding, and production techniques. To use these new techniques effectively requires a larger production unit. More capital per acre and per man are demanded. A larger proportion of this is used in the form of working capital and a lesser proportion in real estate. The situation calls for more technical knowledge on the part of the farm operator. The family still dominates the picture, but it is a larger, more highly capitalized unit.

Porter, W. F., and Metzler, W. H. AVAILABILITY FOR EMPLOYMENT OF RURAL PEOPLE IN THE UPPER MONONGAHELA VALLEY, WEST VIRGINIA. W. Va. Agr. Expt. Sta. Bul. 391. June 1956.

The data for this report, which were collected in July 1954, were based on a sample of 2,287 persons 14 years old and over. Almost 16 percent of these people were either looking for work or were potentially available for employment at the time of the survey. Many of those interviewed were holding temporary jobs at the time. Almost 20 percent of the male heads of households were available for employment, and they were the persons who were most active in looking for work. During the previous 12 months, only a fifth of all those available for work during the week of record had been employed for as long as 200 days. Nine in ten of the workers interviewed preferred full-time nonfarm work. Two-thirds of the household heads and 85 percent of the other males were willing to leave their homes to obtain nonfarm employment. Three-fourths of the male heads of households--the younger ones--were willing to move their families to new locations if they could find nonfarm work by doing so.

Few of the persons available for work had had any specialized vocational training, but a considerable number had previously worked in mines or in manufacturing industries. Some of those who reported no work during the 12 months prior to the interview were young people preparing to enter the labor force. Incomes of those households in which the available workers lived averaged only slightly lower than those of all households in the valley. All valley incomes were relatively modest.

Production Economics Research Branch, U. S. Agricultural Research Service. EFFECTS OF ACREAGE-ALLOTMENT PROGRAMS, 1954 AND 1955. A SUMMARY REPORT. U. S. Dept. Agr. Prod. Res. Rpt. 3, 18 pp., illus. June 1956.

The acreage-allotment, marketing-quota, and associated price-support programs in effect in 1954 and 1955 affected total farm production very little, but production of specific commodities were modified considerably. From 1953 to 1955, total production of 4 basic allotment crops-- corn, cotton, wheat, and rice--was more than offset by increases in production of nonallotment crops. The land and other resources diverted from production of these 4 crops were used mainly to grow feed grains other than corn, oilseed crops, rye, and hay. Acreage allotments plus price supports were not effective in controlling the acreage of corn. Most producers of cotton, wheat, and rice complied with acreage allotments and marketing quotas, but only 40 percent of the farmers in the commercial corn area did so.

Production of crops was not controlled to the same degree to which acreage was reduced, as producers tended to step up use of fertilizer and other yield-increasing practices. Yields of wheat increased by 15 percent and yields of cotton by 28 percent between 1953 and 1955. Between 1954 and 1955, yields of rice increased by 16 percent.

Allotment programs affected major uses of land very little--the total planted acreage of all field crops decreased only 1 percent from 1953 to 1955, and relatively little land was shifted from harvested crops to pasture. Nor was there any significant shift to conservation systems of farming. The programs did reduce the rapid rate of increase in carry-over stocks of most allotment crops. Diversion of land and other production resources from allotment crops to feed grains other than corn resulted in a 10-percent increase in production of feed grains and an accumulation of total stocks of feed grains at record levels. The expansion in production of feed grains and their lower prices tended to encourage an increase in production of grain-consuming livestock, although much of the 6-percent increase probably would have occurred without the allotment programs. The acreage-allotment and associated price-support programs tended to support farm income from crops. The total farm value of crop production decreased between 1953 and 1955, but without the program, the decrease would have been greater. Incomes varied between the cotton, corn, wheat, and rice areas studied for a variety of reasons; among them, degree of compliance with the programs, uses made of land diverted from allotment crops, and level of yields. In all areas the effect of allotment programs on farm income depended partly on the level of support prices in relation to the prices that would have been received if no price support had been available, and partly on the productive use made of resources released by the allotment programs.

Puterbaugh, H. L., Kehrberg, E. W., Dunbar, J. O. ANALYZING THE SOLUTION TABLEAU OF A SIMPLEX LINEAR PROGRAMMING PROBLEM IN FARM ORGANIZATION. Jour. Farm Econ. 39(2): 478-489. May 1957.

This central Indiana farm included 316 acres of a highly fertile, black-prairie type soil. Limiting factors considered in planning were land, labor, hay equivalent, and corn equivalent. Budgets were made for each crop-and-livestock production possibility to obtain choice indicators for use in determining the optimum combination of enterprises by conventional programming procedures. The choice indicator used was "profit" figure per unit of each enterprise.

The farm plan was found to be relatively stable. The price of hogs, the major livestock enterprise, would have to drop from $2 to $3 before other livestock enterprises could compete. But a rise of around $0.50 in the price of hogs would have changed the picture.

Shifting the crop rotation to one producing a great deal of meadow would mean a rather high opportunity cost. Selling the hay was more profitable than feeding it. But deciding not to sell the hay would mean a loss of only $389. Leaving 38 acres of land idle would mean an average cost per acre of $45.03. This information might be valuable in deciding whether or not to enter such governmental programs as the Soil Bank.

The marginal cost figures can be deceiving unless the valid range for such figures is calculated. Some degree of variation in prices or enterprise returns above nonlimiting variable costs can occur without another farm organization becoming more profitable under the programming techniques used. The method of calculating ranges for marginal cost figures is not difficult and is important in evaluating solution tableaus. The method of calculating ranges of the net prices for which programs are optimum is easily followed.

Reuss, L. A., Roberts, N. K., and Greene, R. E. L. PANGOLAGRASS PASTURES FOR BEEF PRODUCTION IN CENTRAL FLORIDA--A METHOD OF DETERMINING THE ECONOMICS OF ESTABLISHING AND FERTILIZING THEM. Fla. Agr. Expt. Sta. Bul. 585, 36 pp., illus. May 1957.

Exploratory budgets, based on specified alternative plans of production and selected combinations of beef prices and fertilizer costs, for an "illustrative" cow-and-calf ranch, indicated certain economic tendencies. With increased fertilization of existing improved pastures, beginning at a low level, net returns would tend to increase up to a point and then to decrease. That is, each step-by-step increase in pounds of fertilizer from 300 to 2,100 pounds per acre would result in smaller and smaller increases in beef yields and gross returns. Similarly, average unit costs would tend to decrease up to a point and then to increase. Large expenditures for fertilizers would be accompanied by certain risks and uncertainties not identified in budgets based on average weather and average prices. The rate of fertilization required for the highest net returns would vary with changes in costs and the price of beef. In the grazing trials cited and in the ranch budgets, the increases in beef production associated with increases in fertilization represent the net effects of changes in forage production and utilization, including any changes in length of grazing season. The profitableness of increasing the acreage of improved pasture would depend on the price-cost situation. More precise economic data for the various types of ranch situations in Florida are needed.

Scoville, O. J., Atherton, J. C., Rogers, R. O., and Davis, K. C. IRRIGATED FARMS IN A SUBHUMID COTTON AREA. INCOME POTENTIALS AND DEVELOPMENT PROBLEMS. U. S. Dept. Agr. Cir. 980, 80 pp. illus. May 1956.

The W. C. Austin Project in the cotton and cash-grain farming area of southwestern Oklahoma represents one of the first attempts to introduce irrigation of a project type into a subhumid area. Before irrigation, cotton farms averaged about 240 acres and cash-grain farms about 320 acres. Irrigation charges per acre vary from year to year. In 1952 and 1953 minimum charges were $3.20 per acre for operation and maintenance and $1.80 for cost of construction. From 1948 to 1950 an additional charge of $3.50 per acre-foot was made for all water delivered in excess of 0.5 acre-foot per irrigable acre. In 1951 this charge rose to $4.00 per acre-foot and in 1952, it was $5.00.

In 1950 the project had about 355 farms; two-thirds of these had between 20 and 139 acres of unirrigable land. Most farms had both irrigated and dry land. A higher proportion of irrigated than of unirrigated land was in cotton and grain sorghums; more of the dry land was used for wheat and pasture. Of the operators, 39 percent were owners, 20 percent part owners, and 41 percent tenants. The irrigated farms on the project have increased in size since the project started. Crop yields could be increased by improving production practices, especially on the irrigated land. Water shortages are more likely to occur in the second half of the year, and yields of alfalfa and cotton would be affected more frequently than yields of grain sorghums or wheat.

A 240-acre farm with 160 irrigable acres was compared with a 340-acre dry farm. At projected prices the net difference in income attributable to water amounted to $4.33 per irrigable acre. With projected prices and yields estimated on the basis of an accelerated 7-year program, an 80-acre owner-operated field-crop farm could provide an adequate family living and repay the costs of development in 8 years.

Sitler, H. G. ECONOMIC POSSIBILITIES OF SEEDING WHEATLAND TO GRASS IN EASTERN COLORADO. U. S. Agr. Res. Serv. ARS 43-64, 39 pp., illus. Feb. 1958.

This report is based on the experiences of 46 farmers in Kiowa, Kit Carson, Washington, and Yuma Counties, most of whom had seeded grasses in stubble fields of wheat or sorghum.

From 3 to 6 years are needed to obtain a usable stand of grass. The Agricultural Conservation Program in 1958 provides cost-share assistance averaging about 50 percent of the costs with a limit of about $5.00 per acre for approved practices. The Conservation-Reserve part of the Soil Bank Program in 1958 provides up to 80 percent of the costs and an annual payment of up to $7 per acre for a period of 5 to 10 years, when the land is seeded to grass under the program. Under the Soil Bank Program the land cannot be grazed except under unusual circumstances and then only by permission of the Secretary of Agriculture.

Net returns from a seeded pasture were calculated through a 12-year period. No grazing is obtained during the first 3 or 6 years, depending on whether 1 or 2 seedings are needed to obtain a stand of grass. Yearling steers are used to stock the pasture after the grass is established, and all assumed gains in weight are valued at 20 cents a pound. The estimated annual net return over the 12 years is $2.56 per acre with 1 seeding and $1.30 per acre when 2 seedings are required. With the 1958 Conservation Reserve Program used for 5 years, the annual average net return over the 12 years is $4.88 per acre with 1 seeding and $3.98 per acre with 2 seedings.

With wheat at $1.70 per bushel and 20 cents per pound gain for cattle, the net return per acre would be the same for wheat yielding 9.2 bushels as for seeded pastures producing 21.8 pounds of cattle gain per acre.

Assuming expenses similar to those prevailing in 1954 and wheat at $1.70 a bushel, with stock water available, and with the other facts set forth in this report, maximum net income is obtained when all land yielding 5 bushels or less of wheat per seeded acre is used as seeded pasture for summer yearlings.

Stippler, H. H. ELECTRICITY ON FARMS IN EASTERN WASHINGTON. Wash. Agr. Expt. Sta. Cir. 149. July 1951.

Farms in the wheat area of eastern Washington vary considerably in size but they do not differ greatly in organizational features that affect the use of electricity. Wheat is the chief crop and beef cattle the predominant type of livestock produced. Less than a fourth of the 299 farms in the sample were connected before 1940; almost half first received electrical service from 1940 to 1944. Average consumption of electricity on farms in this area is high compared with consumption in other areas of the State and was increasing rapidly. In 1948 it averaged 9,845 kilowatt-hours or more than 5 times the 1513 kilowatt-hour average of 1939. The annual bill for electricity increased 114 percent from 1939 to 1948, but the cost per kilowatt-hour in 1948 was only about a third of the cost in 1939. The major peaks of consumption of power occur in spring and early fall--the two periods of major farming activities on wheat farms. More than 40 individual household uses of electricity were enumerated by these farmers. But only air-conditioning units, home freezers, water heaters, ranges, and refrigerators were numerous. Many different pieces of electrically operated farm equipment can be used on wheat farms, but their density on these farms was low, as little use is made of them. Multiple-purpose motors and workshop equipment were numerous; they use a great deal of electric energy while in use but are not used over any long period of time on these farms. Of the total consumption of electricity on farms in this area, 92 percent was used in the farm households.

Sutherland, J. G., and James, H. B. MECHANICAL HARVESTING OF COTTON, ROBESON-HOKE COUNTY AREA, NORTH CAROLINA. N. C. State Col. Dept. Agr. Econ. A. E. Inform. Ser. 53. Oct. 1956.

Data on mechanical harvesting of cotton and cotton production practices were obtained from farmers using mechanical pickers in the two counties in 1953 and 1955. The data on field waste of cotton were obtained from efficiency tests on a number of machines at different times and locations within the area. The Government Grading and Classing Laboratory furnished data on grades for two gins in the area that handled both hand and mechanically picked cotton. The low-drum, barbed spindle picker is the prevailing type in the area. In 1953, these pickers harvested an average of 109 bales and 152 acres per machine. In 1955, which was less favorable for mechanical picking, they harvested an average of only 55 bales from 88 acres.

Operating costs for the two seasons averaged $17.92 per bale and $12.25 per acre in cotton that yielded approximately two-thirds of a bale of lint. These pickers usually left approximately 12 percent of the total yield of cotton in the field. The seed cotton lost as a result of mechanical picking amounted to about $19.26 per bale harvested in this way. Grade loss amounted to $7.70 per bale of lint. As the mechanically picked seed cotton required for a bale of lint is approximately 1,489 pounds as compared with 1,288 pounds of hand-picked cotton, ginning charges for the former are about $1.18 more per bale than for the latter. Total cost of mechanical picking, including field and grade losses and additional ginning charges, averaged $46.06 per bale.

This is equivalent to a hand-picking rate of $3.58 per 100 pounds of seed cotton. Usually some custom harvesting is necessary to bring mechanical picking costs to or below hand-picking costs. The major advantage in mechanical harvesting is that growers are less dependent on hand labor. During some years, however, hand picking may be the only feasible method of harvesting. Substantial improvements must be made in mechanical cotton harvesters before they can significantly improve the competitive position of cotton in the agriculture of North Carolina. A reduction of 50 percent in the quantity of cotton left in the field by mechanical pickers would enable this method of harvesting to compete effectively with hand picking.

Tramel, T. E., Crowe, G. B., and Abel, J. F., Jr. INVESTMENT AND OPERATING COSTS OF IRRIGATION IN THE DELTA AREA OF MISSISSIPPI. A PROGRESS REPORT. Miss. Agr. Expt. Sta. Bul. 559, 27 pp., illus. May 1958.

Based on the 145 farms included in the study reported, investment in irrigation equipment averaged $73 per acre irrigated for sprinkler systems, $57 for gated-pipe systems, $36 for siphon-tube systems, and $50 for other gravity systems. Average investment for the 145 farms was $56 per acre irrigated. Annual operating costs per acre irrigated averaged: sprinkler systems, $18; gated-pipe systems, $18; siphon-tube systems, $8; and other gravity systems, $12. Average annual costs for all systems amounted to $15 per acre, irrigated. Efficiency in the use of irrigation may be expected to increase with increased experience. The operator's planning and management are the chief factors that affect cost. With present practices and techniques, and 1956 prices, an increase in yield of 255 pounds of seed cotton, 15 bushels of corn, or 7 bushels of soybeans per acre would be required to cover the direct and associated costs of two irrigations. Natural surface sources of water, if dependable, conveniently located and properly used, are cheaper than wells. A well delivering 2,000 gallons of water per minute can be developed and equipped for approximately $5,000. Annual pumping costs would average around $0.45 per acre-inch.

Vermeer, J., EFFECTS OF CHANGES IN PRICES, INPUTS AND EFFICIENCY ON FARM INCOMES (1937-39 to 1948-50). Jour. Farm Econ. 36(4): 590-599. Nov. 1954.

To measure these changes, two periods were used as bases for comparison--the average of the years 1937-39 and 1948-50. The years 1937-39 represent a period of relatively stable production. They exclude the worst years of the depression and drought, and they were affected very little, if any, by the inflationary effects of World War II. The years 1948-50 represent 3 postwar years of fairly stable production and prices. On some types of farms--northeastern dairy farms and hog-beef fattening farms in the Corn Belt--about four-fifths and two-thirds, respectively, of the increases in net incomes from 1937-39 to 1948-50 were due to higher prices. Although levels of inputs and production were significantly higher in 1948-50, costs increased also, so that the effect of changes in inputs and production on changes in net incomes was relatively small. Even so, on the hog-beef fattening farms, they accounted for a third of the increase. On spring wheat farms, the increase in net income that was due solely to changes in price represented only slightly more than half the total increase in net income. Nearly two-fifths of the increase was due to greater efficiency. Except for the higher price level, net incomes on Black Prairie cotton farms and Intermountain cattle ranches would have been about the same as or lower than those in the 1937-39 period. The methods used in measuring the effects of the changes are presented in detail.

Whatley, T. J., and Atkins, S. W. INCREASING INCOMES THROUGH FARM ADJUSTMENTS IN THE GRENADA-LORING SOIL ASSOCIATION AREA OF SOUTHERN WEST TENNESSEE. Tenn. Agr. Expt. Sta. Bul. 244. Dec. 1955.

Production of cotton, which prevails in the area, accounts for the relatively low average farm income. Alternative systems of farming are suggested for the present acreages of the sample farms. Total volume of production would be increased by reorganizing the farm and adopting improved production practices. Both measures would require more capital. Cotton would be kept in each alternative system, but the acreage would be reduced in varying amounts, depending mainly on the labor available. The quantity of cotton produced would remain about the same as at present. Assumptions made in regard to the labor supply were that it would remain as at present in the short run and that it would be reduced approximately 30 to 40 percent in the long run. The alternative systems would be developed around cotton and either grade B dairying or the cow-calf type of beef production. Hogs would be combined with dairying, and either hogs or hens, or both, would supplement production of beef. Compared with the present system, these alternatives would permit more complete use of the land resources by (1) incorporating idle land into the cropping system, and (2) increasing production per acre through the use of more efficient production practices. Soils would be better protected from erosion. The labor force would be more fully employed. Cash outlays needed would be 80 to 120 percent of the present average investment. On upland farms, family earnings would rise from roughly $800 to $1,200 to around $2,500. On bottom-land farms, earnings would rise from a range of $1,500 to $2,000 to a range of $3,500 to $4,500. There are certain obstacles to the setting up of these alternative systems of farming. Chief among them are the relatively large amounts of new capital needed. Others include the need to learn new skills and develop higher levels of management, the increased risk involved, and the high percentage of tenancy.

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